WIND FARM FEASIBILITY AND COST ANALYSIS

KOBUK RIVER VALLEY, NOORVIK AND KIANA

By

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WIND FARM FEASIBILITY AND COST ANALYSIS

KOBUK RIVER VALLEY, NOORVIK AND KIANA

A

PROJECT

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By

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Abstract

Western Alaska villages have incredibly high energy costs due to being off the road system. They rely upon the delivery of fuel by air cargo or barge cargo services for their diesel power plants. This is a particularly costly operation, and fuel prices delivered by this method are typically double, or even triple, the national average. In turn, this results in monthly electricity bills of $500/month or more for a typical household in the winter, which most families in this impoverished region can't afford. The Northwest Arctic Borough (NWAB) has some of the highest cost averages of Western Alaska, due to its extreme remoteness and very limited barging capabilities.

This Capstone project will involve researching the high energy costs in Western Alaska, with special attention to the NWAB, compared to both Alaskan and national averages; and, will research the costs of planning, construction, and operations of wind farms in Western Alaska. The project will enlist various research methods, including literary research, interviews, estimating, and cost analysis tools. It will present a cost analysis of designing, constructing, and maintaining a wind farms vs. traditional diesel generated costs. Lastly, it will provide a recommendation to whether a wind farm in the Kobuk River Valley is a worthwhile endeavor.

The final project deliverable will be a research paper and recommendation intended to be used by stakeholders in the energy industry. It will take into consideration initial investment costs, operations and maintenance costs, current subsidies, and any potential long term cost savings.

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Key Words

- Diesel offset
- Kiana
- Kobuk river
- Noorvik
- Northwind turbine
- Price cost equalization
- Renewable energy
- Renewable energy fund
- Wind farm

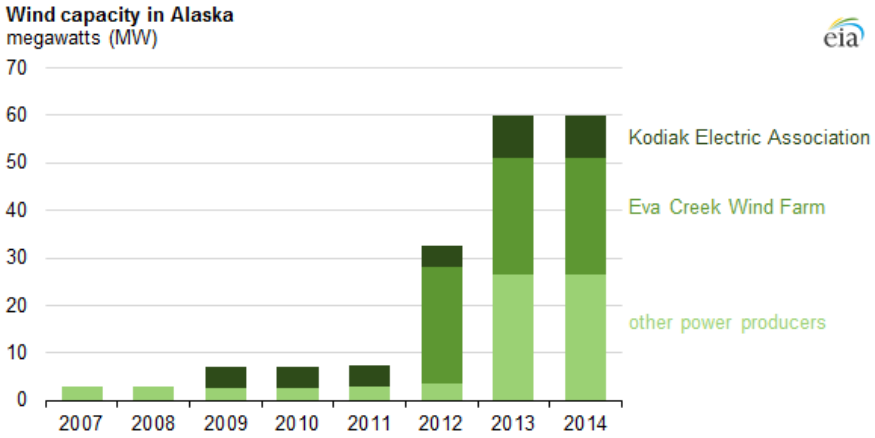
Acronyms

- AEA – Alaska Energy Authority
- AVEC – Alaska Village Electric Cooperative
- DOE – Department of Energy
- EETF – Emerging Energy Technology Fund
- KEA – Kotzebue Electric Association
- M & O – Maintenance and Operations
- NANA – Northwest Arctic Native Association
- NPV – Net Present Value
- NWAB – Northwest Arctic Borough
- REF – Renewable Energy Fund
- PCE – Power Cost Equalization (program)
- PMI – Project Management Institute
- SEP – Strategic Energy Plan
- SWPPP – Stormwater Pollutant Prevention Plan
- UAA – University of Alaska, Anchorage

Introduction

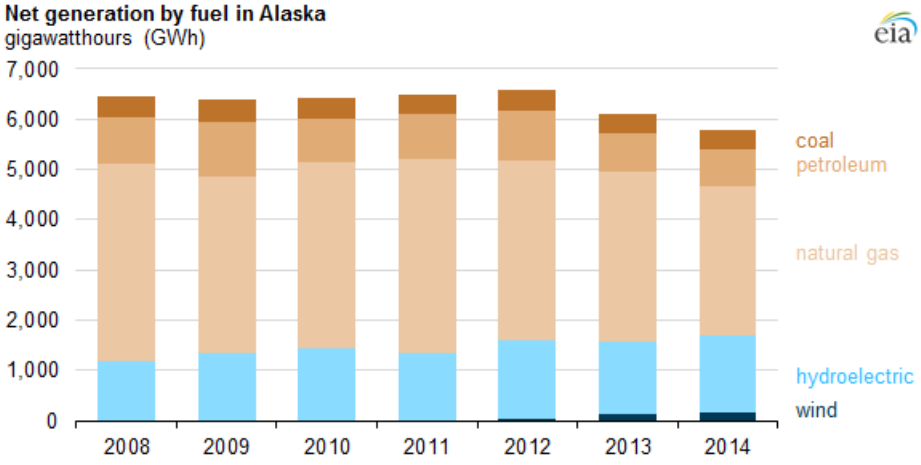
Wind generated power is becoming an important part of Alaska's solution to high energy costs across the State. Over the last five years, twenty two wind generated energy utilities have been constructed, with dozens more anticipated to be constructed over the next five years. In 2011, only 0.3% of the energy produced in Alaska came from wind energy, but this number had grown to nearly 3% in 2014. This is expected to grow to even more in the next five years due to additional projects that are scheduled to begin and have already gained funding.

Figure 1 – Wind Capacity in Alaska, 2007 - 2014



Source: U.S. Energy Information Administration, *Electricity Data Browser*

Figure 2 – Net generation by fuel in Alaska, 2008 - 2014



Source: U.S. Energy Information Administration, *Electricity Data Browser*

What is the reason behind this sudden rush towards wind energy in Alaska? Wind turbine generated power is efficient, renewable, relatively cheap to operate, and is "green," which provides certain financial incentives. Possibly the most important feature of wind energy, though, is utilization of natural resources, which eliminates the need of delivering expensive diesel fuel. This elimination of reliance on diesel fuel is key to the success of wind energy programs. In the past five years, $80 million of diesel fuel was offset in the State of Alaska because of supplemented energy from wind farms (Croft, 2016).

There is a huge potential in Alaska, especially on the western coastline, for wind energy to be used due to the relatively large wind energy potential in the region. Wind energy is also an especially valuable resources in Western Alaska because fuel delivery is extremely expensive. The Northwest Arctic Borough (NWAB,) in particular, has even greater challenges in fuel delivery, making it an ideal candidate for the development of a new wind farm to produce wind energy. Most communities there rely on barges or air cargo planes for the transportation of fuel. This is extremely costly, and results in energy prices ranging from triple to even ten times the national average (EIA, 2011)

Wind energy projects have other benefits, too. They create jobs during both the construction and operation phases, which helps to bolster local economies. They are also more environmentally friendly than diesel powered power plants. They pollute less, reduce the risk of hazardous spills, and have a smaller footprint, because they don't require storage tanks and major facilities to operate. Of course, the ultimate goal is to reduce the total cost of energy. Wind turbine generated power has proven to stabilize energy prices in each successful project in Alaska. They may not significantly lower pricing to the consumer, but they surely stabilize pricing by relieving the reliance on unstable diesel fuel pricing. They also greatly reduce the cost of purchasing, delivering, and storing diesel fuel, which is a huge impact to these small, low budget communities.

There are problems with wind farms, though. They do have a very high initial cost, which can be a capital strain to those responsible in the planning and construction. They also can be costly to operate because they are a relatively new technology, which may not always be compatible with current power systems. Lastly, residents in remote villages using traditional diesel power plants are currently subsidized by the Power Cost Equalization (PCE) program, and the use of wind energy might result in some loss of this subsidization. This subsidization will be discussed in more detail below.

Overall, however, the result of past Alaska wind farm projects have proven that wind turbine generated power is a cost effective, eco-friendly, and worthwhile endeavor. The question is whether or not a wind farm is a feasible and cost effective option on the Kobuk River.

Research Method

The majority of the data from this project came from literary research, with the rest coming from interviews with industry experts. It should be noted that originally a survey was meant to provide more data to the project, but the results did not prove to be of any value. This will be addressed in more detail in the narrative of the project and the lessons learned portion of the final deliverable.

The literary research was done online, through the use of services such as UAA's Consortium Library and Google search engine. These tools were used to find articles, journals, and reports that related to the topic. The following key words were used in initial searches:

- Renewable energy, Alaska
- Alternat* energy, Alaska
- Energy construction projects, Western Alaska
- Costs fuel, Alaska average
- Wind farm projects, Alaska
- Maintenance and operations, power plants, Western Alaska
- Feasibility studies, energy Alaska
- Energy budget, state of Alaska
- Subsidies, energy Alaska

The Google search results did not yield a significant number of journal or reports that could be used in the project; however, they did result in the discovery of websites that had copious amounts of information on the subject (see references for more information.) Using the same key words in the Consortium Library did yield a few journals and articles, but the peer-reviewed research data in Alaska appeared sparse.

During the progression of this project, the research was changed slightly to narrow the scope to only include wind energy in the NWAB. Most of the sources had already been found using the Google searches. However, additional key words were used for a more focused result, as follows:

- Kobuk River Energy, Alaska
- AVEC energy costs
- Construction costs, wind energy Alaska
- Northwind Turbine

The second source of data came from interview responses with some industry experts. Three interviews were conducted; two of which were personal interviews lasting about one hour, and one being an email interview conducted over a few days. Questions were planned and asked during the interviews, with the format consisting of open dialogue. This proved to be a successful method, as it led to less closed-end answers and better results. The interviewees are as follows:

- Director of Alternative Energy, NANA Regional Corp. Inc.
    - Interview – 2.19.16
- Energy Manager, Northwest Arctic Borough
    - Email interview, 2.18.16 – 2.25.16
- Program Manager, Emerging Energy Technology Fund and Wind, Alaska Energy Authority
    - Interview – 2.24.16

The interview questions that were used as starting points of discussion will be included in the appendices [appendix D].

<u>Data Analysis Procedure</u>

The cost analysis will be completed using the following:

- Analogous Estimating: when little data is found (such as actual construction costs in this region)
- Parametric Estimating: when historical data is found (such as operating costs)
- Three-point Estimating: when uncertainties or risks need to be evaluated (such as wind production of energy)

- Bottom-up Estimating: when enough cost data at lower levels is found (such as erecting a turbine)
- Expert Knowledge: when no data is available, an industry expert's estimate will be used

The final cost estimation will be a derived equation:

Model

Planning Costs + Construction Costs + M & O Costs (NPV) – Diesel Offset (NPV) = Total Project Cost

Planning costs will include the following:

- Finance charges (interest payments)
- Project management
- Design
    - Wind analysis
    - Geotechnical survey
    - Permitting, Land acquisition
    - Construction design and engineering

Construction costs will include:

- Installation of transmission lines
- Procurement and installation of wind turbines
    - To include site mobilization and site prep
- System upgrades

Maintenance and Operation costs will include:

- Commissioning of new system
- Initial training

- Equipment upgrades during operation
- General maintenance and troubleshooting

The chosen turbine to be used (Northwind 100) has a life expectancy of 20 years, so all the variable costs will be based on a 20 year life cycle. They will then be adjusted to present value.

The potential energy output will be determined by the wind potential of the chosen area, the number of turbines installed, and any energy loss in power lines. The number of turbines chosen will be determine by the population of the area served.

Project Narrative

This Capstone project followed the Project Management Institute's (PMI) standards for project management, and was overseen by the faculty of the project management program at the University of Alaska, Anchorage (UAA.) The project consisted of the final two semesters of the masters' program, starting in the fall of 2015, and ending in the spring of 2016. During the fall semester, the initiating and planning process group phases of the project occurred; during the spring semester, the execution, monitoring and controlling, and closing process group phases were conducted. A project management plan was written during the planning phase, and was conformed to during the execution phase. It is shown as an appendix to this report [appendix A].

The project management (PM) plan consisted of multiple PMI subsidiary management plans, but did not include all plans. Those subsidiary plans that were not applicable to this project, such as a procurement management plan, were not included. The change management plan was referred to most during the project, due to the large amounts of changes that occurred during the project execution phase.

The project had multiple changes throughout the planning phase, and then again during the execution phase. This was due to either lack of information available or too broad of scope for the

relatively short project. During the initial planning phase of the project, the goal was to research high energy costs in Western Alaska. This was too broad of a topic, and did little to contribute to the project management or other general body of knowledge. There also was a multitude of research already conducted by the Department of Energy. The scope was then changed to developing renewable energy sources in Western Alaska, in order to tighten the focus. However, there was little gain from just researching this kind of development, so it was decided to change the scope, again, and create a cost estimating tool for renewable energy development. At the completion of the planning phase and the finalization of the PM plan, this cost estimating tool was the scope of the project.

During the execution phase of the project, particularly during the initial research stage, the idea of creating an effective and easy to use cost estimating tool was determined to be a futile effort. The Department of Energy had already created such a tool at a national level, but it was incredibly high level and difficult to use. It also required information as inputs that were either not readily available or did not work with Alaska's unique construction conditions. Creating a cost estimating tool more specialized for Alaska was a good idea, but there is just not the information available to the general population that would make such a tool useful. During the collection of what data was available, however, it was discovered that a cost analysis instead of a tool would be just as effective as an end result for this project.

While formulating the type of analysis necessary to create an end deliverable, it was discovered that Western Alaska is too diverse to include all of it in a research report. Instead, a specific area must be researched. At this point in the project, the project manager (PM) decided to research the Kobuk River Valley as an area to analyze the cost and feasibility of a wind farm. The PM had extensive experience and knowledge of this region, so it would be the ideal area to examine. Once the scope had been finalized, the research method had to be adjusted to suit.

The research method is described above, but changed due to lack of results. Originally, the plan was to release ten to fifteen surveys with general questions in order to add to the data of the project. However, after multiple attempts, not a single survey was returned. This occurrence was noted in the risk register, and the project changed as per the risk response implementation. An additional interview was conducted in order to collect additional data that may have been gathered during the survey process. All of these changes were documented in the change tracking log.

Research Results

High Costs Alaska

According to the 2011 Alaska Energy Statistics Report (Fay, 2013), "Alaskans in small remote rural places that rely on fuel oil had the most expensive electricity—with prices from roughly 30 cents to more than $1 per kilowatt-hour in 2011." This is compared to an average cost of $0.127/Kilowatt-hour in the United States, as reported in November, 2015 (EIA website, 2015). In the Kobuk River Valley, prices ranged from $0.61/Kwh (Selawik) to $0.83/Kwh (Kobuk and Shungnak), with an average of $0.73/Kwh (AEA PCE, 2014) from July 2013 to June 2014. To further exacerbate the situation, the villages in this region have an annual household income approximately 10% lower than the United States, and 20% lower than the rest of the State of Alaska (Fried, 2015).

Potential Wind Energy

Wind energy has become the fastest growing energy source in Alaska over the past 10 years. (Fay, 2013) Growing from a mere 2,355 kilowatts of installed capacity in 2007 to 13,846 kilowatts in 2011, and finally 64,751 kilowatts in 2012. The major increase in 2012 was from two large production plants (Eva Creek and Fire Island) which utilized the populations of Anchorage and Fairbanks and their future needs to sustain such massive projects. These projects aren't suitable everywhere, though; first the potential wind energy must analyzed.

Potential wind energy is based on a scale of Class 1 – Class 7, with 1 being the lowest and 7 being the highest. This class system is based on average wind speeds at 10 meters and 50 meters, using incremental steps. For instance, Class 1 is based on average wind speed less than 12.5 mph, Class 2 is between 12.5 mph and 14.3 mph, etc. at 50 meters above ground surface. Class 7, the highest is based on average wind speeds over 19.7 mph. "Areas designated class 3 or greater are suitable for most utility-scale wind turbine applications" (Vaught, 2008), but typically, in Alaska, wind farm locations are

sometimes chosen in areas with at least a Class 4 distinction, due to the relatively high construction and maintenance costs. Class 3 or 4 wind classifications will be looked for in the feasibility analysis.

Renewable Energy Fund

The Alaska Renewable Energy Fund (REF) provides benefits to Alaskans by assisting communities across the state to reduce and stabilize the cost of energy. The program is designed to produce cost-effective renewable energy for heat and power to benefit Alaskans statewide. The program also creates jobs, uses local energy resources, and keeps money in local economies. Since its conception, the REF has provided over $227 million in grant funding for renewable energy projects (Croft, 2015.)

The REF was created in 2008 by the State Legislature, and was extended for an additional 10 years in 2012. This fund has had a major impact on wind energy in Alaska, and is one of the reasons why wind energy has grown so immensely in the past eight years. Seven of the past eight years have resulted in over $20 million/year in appropriated funding per this program. Due to State budgetary issues, this amount is expected to fall below the $10 million range over the next few years. For 2016, only $4 million is allowable for villages with high energy costs (Fisher Goad, 2015), such as villages along the Kobuk River. There is an application process for each project, but generally speaking, if a project is worthwhile funding is made available to a certain degree. The target spending for this program has recently been changed to 50% of spending towards reconnaissance and feasibility and 50% towards design and construction. There is also the potential for matching funds from other agencies, such as the Denali Commission, and from other grants, such as the Strategic Energy Plan grant from the Department of Energy.

In 2009, $10 million was granted to the Northwest Arctic Borough for feasibility studies and the potential design and construction of wind farms in the villages of Buckland, Deering, and Noorvik. This grant was originally applied for by NANA, however, they were ineligible to receive it. The NWAB and NANA teamed to use this grant funding, and NANA provided “in-kind” management of the program to champion it to a success. It took many years for construction to begin, but in 2015, both Buckland and Deering wind farms were finally completed and commissioned. The Buckland wind farm project cost $6.3 million, and the Deering wind farm project cost $2.7 million. The rest of the grant funding has gone to studying wind energy in the Noorvik region. (Adams, 2016)

It is important to note that this funding source is not easily accessed. There is a lengthy and complex process for applying for the funds, which can easily take a year or more. This process has costs with writing the applications, researching, etc. These costs are typically borne by the applicants, which may include utility companies, local entities, or regional native corporations.

Emerging Energy Technology Fund

The emerging energy technology fund (EETF) was created in 2010 by the State of Alaska legislature to provide funding for supporting new technologies relating to energy resources. The most important criteria is that the projects supported will "become commercially viable within 5 years." (AEA, 2016). Furthermore, the projects must either "test emerging energy technologies or methods of conserving energy; improve an existing technology; or deploy an existing technology that has not previously been demonstrated in the state." (EETF data sheet, 2015). Since its inception in 2010, over $10 million of funding has been granted for these projects. Due to the terms of the criteria, it is unlikely that the proposed wind farm can take advantage of this funding; however, any new technologies for the storing of energy or updating the existing systems in Noorvik or Kiana may be viable options.

Power Cost Equalization Subsidy

The Power Cost Equalization Program (PCE) is a State funded program that helps to reduce high energy costs in rural Alaska. It provides relief to families by subsidizing part of their energy expenses. It takes average Kwh costs per community and pays a certain percentage of that cost. The goal is to get the cost paid by consumer to be the same as an average cost of Anchorage and Fairbanks rates. In other words, this program is meant to allow energy consumers throughout the state to all pay a similar price for electricity, regardless of location. However, it does not aim to create equal pricing. Approximately 93% of communities subsidized by this program still pay higher rates than Anchorage averages. In 2011, 191 communities participated in this program.

The PCE subsidy only provides relief for the first 500 Kwh of energy use per household, per month. For instance, in Noorvik, the cost of energy is $0.57/Kwh, and residents receive a PCE subsidy of

$0.37/Kwh for the first 500 Kwh, per month. If a household were to use 700 Kwh in a particular month, they would spend $0.20/ Kwh X 500 Kwh + $0.57/Kwh X 200 Kwh, for a total of $214 at an average rate of $0.31/Kwh.

Only residential households can receive this subsidy, not commercial users. So when looking at the potential savings, the commercial usage, such as schools, can skew the numbers. It is estimated that in order to add commercial users to the program, $11 million in additional funding would need to be appropriated (Fay, 2012). Lowering the cost by using wind energy systems may not directly affect the price a residential user pays because of this subsidy; however, it will always help the commercial customer.

The PCE is a trust fund, much like the permanent dividend fund, and therefore is not directly affected by renewable energy projects or out of state funding. It is currently making more money than is needed for the annual output spending going to remote residential users. The amount of money saved with wind energy systems, therefore doesn't have much to do with this subsidy. Instead, the lowered cost will help these remote villages by offsetting diesel fuel purchased by the village.

Diesel Fuel Offset

The other factor to consider with wind energy is the diesel fuel offset a village might realize. Diesel offset is the amount of diesel fuel that a power plant would have to use in order to produce the amount of energy provided by the wind towers. For example, if a remote power plant uses 1000 gallons/day to power its generators, and the wind towers allow the plant to only use 900 gallons/day because of their energy input, the diesel offset would be 100 gallons/day, or 36,500 gallons per year. With diesel prices averaging around $6.00/gallon in this area, this offset would equate to $219,000 of diesel fuel not purchased. The diesel offset has to be analyzed when looking at the total cost savings. This offset is partially determined by a wind tower's wind penetration.

Power plants cannot rely entirely on wind energy to support the system, as it is both too intermittent and does not have enough potential energy. When looking at wind systems, there are four levels of wind penetration to consider. A very low penetration system is one that wind energy offsets less than 8% of the diesel fuel needed to power the generators. A low wind penetration system offsets

between 8 – 20% of diesel fuel; a medium penetration system offsets between 20-50%; and, a high penetration system offsets over 50% of the diesel in the system. High penetration is highly unlikely due to the amount of wind or wind towers that would need to be present compared to the energy output of power plant. Typically, the goal of wind towers are to gain medium penetration, and more specifically between 20% and 30%, as this creates the most efficient combination of wind and diesel power. However, in remote villages, where that kind of penetration may not be achievable, such as in class 3 potential wind areas with a small demand, a low penetration is still worthwhile (Croft, 2016)

Wind Costs vs. Diesel Costs:

It was noted above that the cost of diesel power energy in the Kobuk Valley averaged $0.73/kwh, and these communities were subsidized approximately $0.52/kwh by the PCE. This means that the effective rate is around $0.20/Kwh. So in order to move forward, the cost of energy created by a wind turbine generator must at least stabilize the price or produce it at less than $0.73/Kwh. The Northwind 100 Turbine can produce power at its full capacity at a variable cost between $0.10 and $0.20 /KwH (NREL). However, that does not include the relatively high initial construction costs, changes in maintenance and operation costs, and other factors. For this initial feasibility, energy costs for existing wind farms will be used.

Concerns with Wind Energy

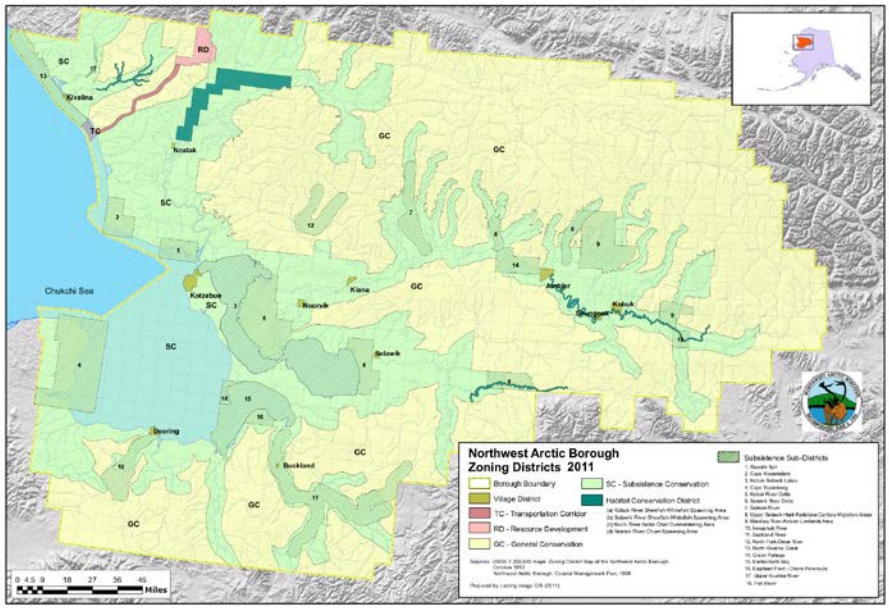
Utility companies don't necessarily have to accept power from wind power producers, even if the cost was lower than their existing diesel systems, which is different than in most other states. In the lower 48, independent companies can construct wind farms as an investment and sell their power to utility companies with a guarantee of purchase of power. If these projects aren't economically viable for the utility companies that utilize the energy and distribute to the community, they will never get off the ground.

Icing in the deep winter chill periods can effectively eliminate any production during those time periods, so in some locations, especially near the coast where ocean water is more prevalent. Wind farms may not reach expected production efficiency rates.

Land Acquisition and Permitting Problems

Another major issue with wind farms is the amount of land area they need. Not only do the wind towers and support structure take a lot of room, there are also roads and transmission lines that need to be accounted for. Most, if not all, of the land in these remote villages is owned by native corporations or has been given to local native communities. This land was given away by the Alaska Native Lands Settlement Act of 1971. As such, nearly all of these projects need to first acquire land from these Alaska Native associations before construction planning can begin. This is a long and not always successful process. Local communities are not always agreeable to giving up land, even if it is for the purpose of projects that will benefit the community. This is because the land is used for hunting, berry picking, and other activities that are important to the culture. Constructing transmission lines or roads may disrupt the herding patterns or caribous, for instance, which can have a negative effect on the subsidence hunting for the community. A zoning map is below, which shows the wind farm and transmission line would fall into subsistence conservation, which requires a Title 9 permit.

Figure 3 – NWAB Zoning Districts, 2011



Similar to the problems with land acquisition, permitting issues can also put a halt to construction projects in remote Alaska. The NWAB requires a Title 9 permit for all construction activities in the region. This permit consists of an exhaustive process that includes the presentation of a detailed plan of all construction activities. The plan is reviewed by the NWAB to ensure no disruption to the subsidence lifestyle of the communities, and that the plan abides by all State regulations, such as adhering to a Stormwater Pollutant Prevention Plan (SWPPP). A SWPPP is a plan to prevent any dirt wash-off to enter rivers, streams, lakes, or wetlands, which may have an adverse effect on the environment and wildlife.

This Title 9 permit, SWPPP, and others take a long time to acquire, and also take a considerable amount of effort by a team during the planning phase of any construction project in the region. One constraint that typically is part of the Title 9 permit is that no construction can take place during the hunting or fishing seasons, which puts further limitations and costs to construction in rural Alaska. The review process of all of these permits are typically between 30 and 90 days, so sometimes an entire construction season may be loss awaiting reviews and approvals. Finally, once these permits are approved and in place, a lot of time is needed to update and amend the permits, as the construction progresses. For instance, weekly or bi-weekly inspections must be made and reported, as a part of the SWPPP. These costs must be considered, as a part of the planning/project management portions of this wind farm development project.

Feasibility Analysis

Before conducting any kind of cost analysis of constructing a wind farm, one question must be answered: is there enough potential wind energy to support a wind turbine generator?

The map below shows potential wind energy throughout Alaska. The area that will be considered is an area near the Kiana Airport, as it has the highest potential wind energy in the region, and is located relatively close to a community so that additional transportation infrastructure will not be needed. This is also a somewhat central location in the Kobuk River Valley, which would be useful for potential future power lines to other communities.

Figure 4 – Alaska wind power classification map, 50 meter

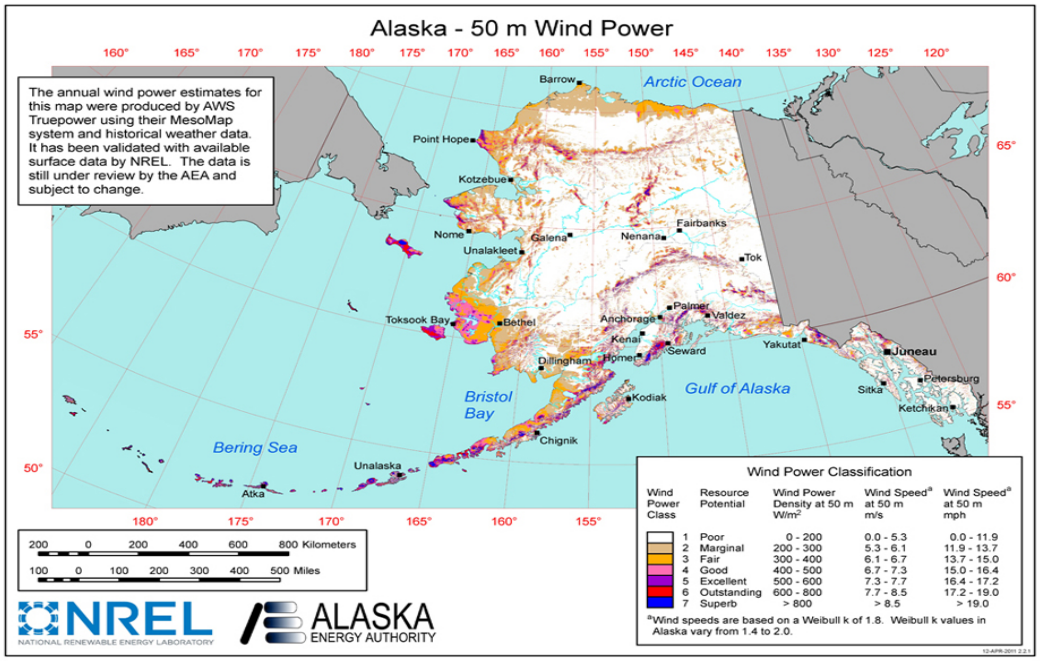
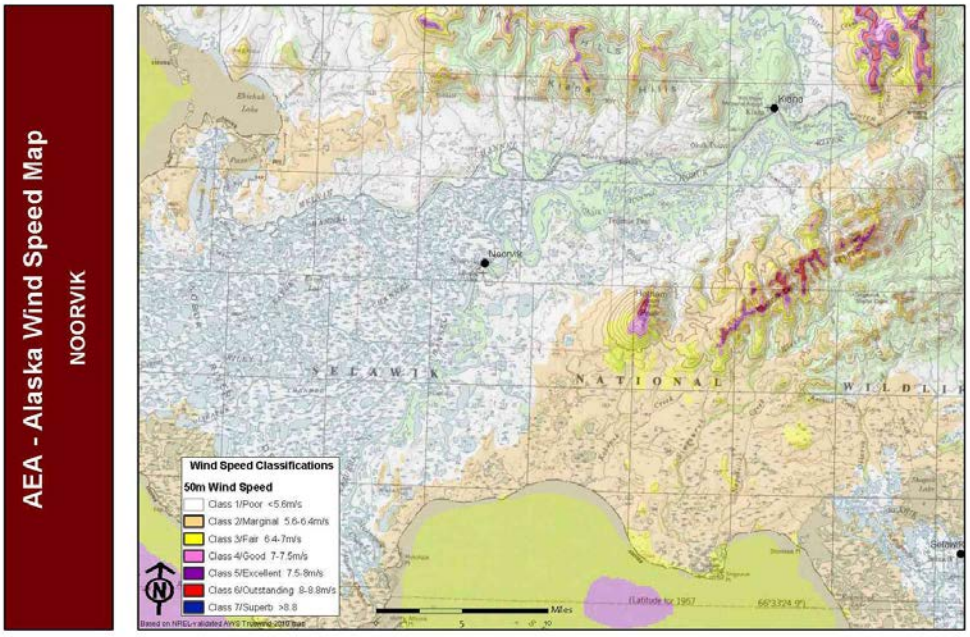


Figure 5 – Noorvik and Kiana wind power classification map, 50 meter



NREL/AEA, WINDExchange program – US Department of Energy

Kiana

Kiana is a small village on the Kobuk River with a population of just over 400 people, with the majority being Inupiat Eskimo Natives. It should be noted the 2010 U.S. Census reported a pop. of 361, showing some substantial growth recently. It is located approximately 60 miles east of the regions' largest town of Kotzebue. The village was established as a trading outpost for miners in the area in the early 1900's, but was not incorporated as a city government until 1964.

Kiana itself likely has a class 3 potential wind energy (Vaught, 2008), while there are also some areas east of Kiana with class 4 or even 5 potential wind energy. These areas in the hills surrounding Kiana, are approximately 3 miles away from the current facilities which would require new lines, roads, and site preparation. These may be cost inhibitive when looking at the logistical challenges of building a road to the site, finding a suitable location in the hills, and maintaining the turbines so far away from the central facility.

Since the population of Kiana is 361 (2010 U.S. Census), it may not have enough consumption capacity to support the initial costs of a wind farm project. However, when utilizing the populations of nearby village Noorvik (pop. 668, 2010 U.S. Census), there may be enough capacity to pose an interest. This grid would also allow for further expansion of either village, which would be useful if a large school or other facility were to be built. It is 19 miles from Kiana to Noorvik, however most likely the power line between the two villages would follow a route that would be a few miles longer, due to terrain constraints.

Kiana currently gets their power from a diesel fueled power plant that has four diesel generators, with a generating capacity of 1,173 Kw (AVEC website, 2015). The village has a current storage capacity of approximately 120,000 gallons. The four generators mentioned above use approximately 140,000 gallons of fuel a year, in order to output the total energy required by Kiana (Devine, 2005), so the village must receive fuel at least twice a year to support the energy needs. The diesel fuel is primarily brought into the village by barge, with the current provider being Crowley Petroleum Distribution. Crowley gets diesel fuel out of Seattle on a yearly basis, and stores the fuel in tanks in Kotzebue, AK. Kotzebue is only reachable by barge from July to early October, so there is a short window for these fuel deliveries. The fuel is then transferred onto a smaller barge carrier, and taken up the Kobuk River to the multiple villages. There is only a very short time window in which the

river is navigable by barge, usually only lasting between three to six weeks. In recent years, only one or two trips have been able to make it up river to these villages. All of this transferring and storing of fuel is expensive, and the diesel rates in the past few years in this area has averaged around $6.00/gallon.

Turbine Selection

Alaska Village Electric Cooperative (AVEC) provides electricity to villages across Western Alaska, and has constructed nearly a dozen wind farms since 2003. The majority of these wind farms are in the Yukon/Kuskokwim Delta (YKD) due to the high potential wind energy in that region. AVEC has used a Northwind 100 type of turbine in all of these new facilities. The Northwind 100 wind turbine has the capacity of 100 kW hours, and has a design of life of 20 years. Their towers stand at 37 meters, and have an apparent noise level of 55 decibals at that height (NPS Spec, 2009). These turbines are so widely used by AVEC because of their relatively small installed capacity (kW), low purchase/installation costs, and ease of expansion. They can also be used in combination with existing diesel generated power plants, and don't need entirely new facilities for the distribution of energy. Below is a picture of an installation of three turbines in Toksook Bay in 2006. A fourth turbine was installed there in 2010.

Alaska Energy Wiki, Northwind 100 Turbines at Toksook Bay

Most of the villages in the YKD have populations under 1000 (with the exception of hubs such as Bethel or St. Mary's). This mirrors the populations in the Kobuk River Valley, which makes for a valuable comparison. These turbines have a capacity to deliver 100 kW of wind energy each, which can power about 25-30 homes, a perfect amount for the low population zones of this region. They can also be easily combined to provide more power. That is, multiple wind towers can be constructed to bump the capacity up in 100 kW intervals, while having little effect on the cost to produce energy at the facility. AVEC utilizes 3 or 4 turbines in some of the more populated villages they provide service for. Using the population of Kiana and the two closest surrounding villages, Ambler and Noorvik, it could be expected that 4-7 of these such turbines would be needed to provide enough capacity for that region, if transit lines were also installed. Once the correct facilities are in place, these turbines can produce power at the cost of $0.10 - $0.20/ KwH. This is well below our

Feasibility Conclusion:

The Kiana/Noorvik site chosen has at least a class 3 wind energy potential, has the need for a wind farm, has prior project experience in the region, and has the demand for use of the chosen Northwind turbines. Overall, this is considered a feasible location for this study. The cost analysis below will determine if the project is a worthwhile endeavor.

Cost Analysis

Overall Model:

The below model is used to determine a total project cost for the development of a new wind farm in the Noorvik/Kiana area. This total cost will then be used to make a final determination and recommendation as to whether the project should move forward, hold, or stop.

Planning Costs + Construction Costs + M & O Costs (NPV) – Diesel Offset (NPV) = Total Project Cost

This project has determined there to be eight types of costs to consider on the analysis of creating a wind energy producing facility/operation during the three phases of the project: the development/planning phase, the construction phase, and the maintenance and operations phase.

There are four costs during the development and planning phase; the financial fees associated with interest payments, the project/program management costs, the permitting and land acquisition costs, and the design costs. The design costs include the wind analysis study, the geotechnical survey, and the construction design and engineering. All four of those design costs are at an expertise level that will require contract work with specialized organizations.

There are four types of costs to consider for this type of construction project: mobilization and site prep; installation of transmission lines; purchase and installation of the wind turbines and supporting structures; and integration of the existing systems. During the interviews and research for this project, the mobilization and site prep costs were nearly always grouped into the installation of the turbines. They were not always treated as a separate cost, and therefore will be considered a part of the installation cost of the turbines for this analysis.

The last type of cost for the project is maintenance and operations. This includes: the initial cost to commission the system; the cost of training labor to operate the system; the cost to replace equipment in the system; and, the general maintenance of the new system. All of these costs range greatly with the number of and type of turbines installed.

Disclaimer: There's no such thing as a free lunch. Everything has a cost, but that cost may not be DIRECTLY related to this proposed wind farm project. For the purpose of this cost analysis, only direct costs to the project will be included. For instance, the AEA employs nearly a dozen employees that directly or indirectly work with renewable energy research and development. They are the people that review grant proposals and oversee appropriations. However, they are working on multiple projects within the State of Alaska, and are tasked with many other responsibilities unrelated to this single project. Their salaries comes out of the State budget, and while is a real cost, is not a direct cost to this project. To make this analysis simple, those kind of costs are not factored into the overall cost of this project.

Development and planning costs:

Finance Costs:

There are multiple grants and bonds that can be used for the research and design of renewable energy projects. The REF is the most readily available and used grant for projects in Alaska, which provide grants with minimal financing fees. There are also other federal bonds available, such as the Clean Renewable Energy Bond, which can provide a near-zero interest loan available through the federal government. As such, for the purpose of this cost analysis, the finance costs of this project will be considered insignificant. It is very important to note, however, that with the declining funding of the REF, this type of cost may need to be reconsidered in coming years.

Project/Program Management:

NANA has previously offered "in-kind" services for these kinds of projects in this region, as it is their goal to provide the most cost-effective energy to their region that is available for long term benefits. AEA and other State and Federal entities also work with these projects in oversight. Although there are real costs for these companies, for the purpose of this cost analysis, the PM costs of this project will be considered insignificant.

Permitting and Land Acquisition:

Once a project is set in motion with a funding source, and the general location is chosen that best suits the wind potential of the given region, the permitting and land acquisition process must begin. There are various permits needed in the NWAB, as described previously, which may take between 90 days to over a year to acquire. This permitting process takes manpower to research and write plans and applications, which can be a considerable cost. The Buckland wind farm project cost $28,000 in just the permitting process. That included both specialized firms who write the plans used for permitting and in-house costs of NWAB for reviewing and managing the application and review process.

The land for this project is all owned by the NWAB. It is all a part of the subsistence conservation zoning district (see figure 3 above). As such, the NWAB Planning Department and Borough Planning Commission will need to be engaged to begin the process of gaining easements, right of ways, and land plots for the wind farm, transmission line and roads. However, since the NWAB has already received funding for work in this area, a lot of this cost can come from the original REF grant. Nearly $1million was left over from the initial 2009 grant awarded, which helps pay for these land and permitting costs. According to the Program Manager for NWAB, it is expected that $25,000 to $50,000 will be needed for the permitting and land acquisition process. Using this and the previous costs for Buckland, it is estimated that $31,000 be needed for permitting and land acquisition.

Design Costs:

There are three kinds of design costs in a project of this type. First, a yearlong wind analysis must be conducted to prove the potential wind energy of a project location. Second, a survey of the site and geotechnical data must be collected in order to determine an appropriate location for the tower and transmission line. Third, the construction project and system upgrade must be designed and engineered.

Wind Analysis:

Prior to the original $10 million grant from the REF that was given to the NWAB in their Deering/Buckland/Noorvik program, a wind analysis had to be done to prove that these villages could sustain a wind farm. V3 Energy LLC was contracted to complete these studies, and they have already been completed. The additional feasibility study has also already been conducted, as a part of the Buckland/Deering/Noorvik project that was original funded by the RER. Wind analysis usually cost, on average, $100,000 at each location. As mentioned in the model summary, this cost will not be included

in this projects' cost analysis because it has to occur prior to grant funding, and in this particular case, has already occurred to a certain degree. Additional wind analysis may be needed, but generally, the data is already available. For the purpose of this cost analysis, it will be assumed that only partial, additional consulting analysis will be needed, with an estimated cost of $25,000.

Geotechnical Survey:

A survey and geotechnical report must be completed after selecting a potential site for a wind farm, in order to demonstrate the constructability of the project. These turbines require a large foundation to support the height and weight of the structures, and that foundation may vary depending on the terrain. Survey data also needs to be collected to design the project. The survey and geotechnical study cost for a remote site like this costs between $75,000 and $150,000. Buckland had a total cost of $160,000 for this research, which included a four mile line. For this location, however, a 26 mile transmission line will need to be surveyed, which will take five to seven times more data points and time to gather information. Also, there is not a current road or even trail at the proposed location of the transmission line, so rough terrain will come into play, adding costs. With all those considerations, it is expected that the survey and geotechnical report will cost $550,000.

Construction Design and Engineering:

The last portion of the design phase of this project is the construction design and engineering, which also includes the permitting and land acquisition process. An engineering firm will take all the information to design the type of foundation, transmission line, access road, etc. so that the project can be completed with certain expectations. For instance, the foundation must be designed using structural calculations such that it can maintain support for the wind structure under certain conditions, such as high winds, earthquakes, or floods. The design of this kind of project can vary greatly, so an analogous estimate will be used with the design costs of other projects in this area. According to AEA's wind program manager, this portion of the design costs between $300,000 and $500,000. A total cost for the design and engineering of this project is estimated to be $433,000.

Construction Costs**:**

Transmission Lines:

The cost of building transmission lines in Alaska ranges from $200,000 per mile to $2 million per mile , according to the U.S. Energy Information Administration (EIA, 2016). However, this figure can include some rough mountain terrain that may require helicopters for placing of power poles, so the upper end is skewed. The Buckland wind farm that was constructed in 2014/2015, had a four mile long transmission line from the tower location the distribution facility. This line had an average cost of $280,000 per mile. The Deering wind farm that was constructed in the same time period had a 1.5 mile transmission line constructed for $400,000 or $266,000 per mile. Both of these transmission lines, required the new trails or roads to support the equipment access, which is included in those average rates. Using this data, and an estimate from NWAB energy manager, it can be reasoned that a transmission line between Noorvik and Kiana would cost $300,000 per mile, as they have similar constructability constraints. The distance between Noorvik and Kiana is 19 miles, however the routing would probably be between 24 and 28 miles. Using 26 miles, this cost is estimated to be $7.8 million.

Turbines:

According to the NREL, the Northwind 100 turbine costs between $300,000 to $600,000 to purchase and install. It should be noted that does not take into consideration some of the harsher environments and logistical challenges in the NWAB. According to former wind program manager for AEA, Rich Stromberg, “Wind turbines in the ~100-kilowatt (kW) size range typically cost $12,000 to $17,000 per kilowatt to install and integrate.” (Stromberg, 2013) or between $1.2 and $1.7 million for a Northwind 100 turbine. This gives an overall range of $300 thousand to $1.7 million per turbine. However, both of these are somewhat broad estimates, and don’t account for all of the concerns of delivering and installing a turbine in the harsh conditions near Noorvik. According to AEA’s current wind energy program manager, a wind turbine of 100Kw size costs between $1 million and $1.5 million, with purchase and installation costs. This accounts for mobilization, transportation, and prepping the site for installation. The actual cost of 100 Kw turbines purchased and delivered, but not installed, to Buckland was $992 thousand each (two total), which provides a better comparison to costs in this region. Noorvik has slightly higher transportation costs than Buckland, however, it also has more available resources – such as an existing gravel pit and available equipment – so their costs are analogous. The cost

estimation for a Northwind 100 turbine, purchased, delivered, and installed in Noorvik is $1.05 million per each, or $4.2 million total.

System Upgrade:

The new wind turbine produced energy must be integrated into the existing power system. In order to do that, the existing diesel facility and distribution system must be integrated to use the wind power. The lower the wind penetration, the lower the cost to upgrade. In this scenario, a medium penetration is the goal, much like it was in Deering. In that location, the upgrade cost $240,000 to integrate the new power system with the old system. This included both new equipment and the installation of this new equipment. Deering, however, had a relatively outdated system to begin with, and some of these upgrade costs also included upgrading existing systems, not just integrating them. BOTH Kiana and Noorvik have older systems, so both would have to be upgraded. Using other information from industry experts, combined with the above, it is estimate that a system upgrade in this region to both Noorvik and Kiana's systems would cost $600,000.

Operation/Maintenance Costs:

Commissioning and training:

Once construction is complete and the system has been upgraded to handle the wind energy, the next step commissioning the equipment and then training local residents to operate and or maintain the facility. In remote Alaska, this expense is much larger than any other location in the country. The commissioning has to be done by a highly trained person, typically a manufacturer's representative. The training usually occurs at this time, as well, but there is also future trouble shooting that must be accounted for. Luckily for this region, however, Kotzebue Electric Association (KEA) has been on forefront of this technology for many years. They were one of the first utility companies to operate a wind farm, with initial projects being completed in the 1990's. As such, KEA has a lot of knowledge and experienced employees to help with this troubleshooting process. They also have experience with different types of turbines in the Arctic region, and their lessons learned are of great value to new projects. Additionally, a new Department of Energy (DOE) assistance program for technical support is offering funding between $300,000 and $1 million over a 3-5 year period, which can be used for

coordination, technical support, and training. With the technical support available locally, and the potential funding available through DOE, the training cost of this project is of insignificant value. The commissioning, therefore, is the only true cost to this project which is minimal, as it only includes travel, labor, and expenses for manufacturer's reps. It is estimated that the cost for this is $50,000.

Maintenance and equipment upgrades:

Generally speaking, there is no additional cost to maintain the wind turbines and distribute the energy than it would cost to maintain a diesel power plant. The same facility is used to transfer energy, and typically the same labor force is used to operate it. There are equipment upgrades to consider that might enhance the existing system, but the actual turbines have an expected life of 20 years. Similar equipment upgrades might also be needed for the original, diesel power. There are no additional costs needed for equipment upgrades after the first year. As for maintenance of the equipment, there is highly specialized personnel required. Luckily, KEA has a long history of maintaining wind turbines, and a lot of their previous experience can be used during maintenance. It is expected that between two and four times a year (Croft, 2016), during the first five year, someone will need to fly to the Kiana/Noorvik wind farm to help with general maintenance or trouble shooting. After that grace period, the trouble shooting should be accomplished by phone. Using an average of $10,000 per trip, at fifteen maintenance trips needed, it is expected that $150,000 will be the cost of non-routine maintenance.

Total Cost**:**

The total costs from above are as follows:

Development/Planning Phase:	$ 1,039,000
Construction Phase:	$12,600,000
Maintenance/Operations Phase:	$ 200,000
Total Estimated Cost:	$13,839,000

Diesel offset

As discussed above, the wind penetration plays an important part in how much diesel can be offset, as it determines the efficiency of the wind farm. The turbines chosen for this project, four each Northwind 100's, are not as efficient as some of the larger 250-500 Kw turbines. They typically fall into a low penetration class, which means they only offset between 8% and 20% of the diesel. However, to further lower the efficiency, the chosen area for the wind farm is only a class 3 site, with a potential of being a class 4 site. This will place the efficiency on the lower end of the low penetration class, so it can't be expected to offset more than 10% of the fuel at these plants.

Kiana uses approximately 140,000 gallons of fuel a year, and Noorvik uses approximately 160,000 gallons a year, for a total of 300,000 gallons. If the above assumptions are true, it can be expected that 10% of this fuel can be offset by the newly developed wind farm. This would be 30,000 gallons of diesel fuel, a year, that would no longer need to be purchased by these villages. Since the average price of fuel in this area has been around $6.00/gallon, this would be a savings of $180,000 per year. Fuel prices are unpredictable, especially of late, but have recently gone down substantially. It would be expected that the fuel in this area will fall well below $6.00/gallon over the next 20 years. For the purpose of this cost analysis, a conservative price of $4.50/gallon will be used, 2016 dollar (this relates closely to the average price of fuel in this region adjusted to 2011 dollars over the past 20 years [Fay, 2013]). The population of these two villages has been somewhat stable, so it will be assumed similar fuel needs will be needed over the next 20 years. That would mean over the next 20 years (lifespan of turbine), 600,000 gallons of diesel would be offset, at $4.50/gallon, or $2.7 million. This would have a net present value of $2.0 million.

Conclusions

Before looking at the dollar amounts of costs and savings, some further discussion must be made to fully understand the value of such a construction project. For the purpose of analysis, this endeavor must be looked at in a vacuum. No mention was made above as to societal costs of the REF source because it comes from a federal pool of money. In order to objectively examine the value of this wind farm project, the REF has to be represented as "free" money. Without a doubt, there is a true cost to this funding source; however, like all grants, if that money doesn't get spent by this project, it will be spent elsewhere. The cost of not applying for and receiving this grant money is null. The recently completed Deering and Buckland projects received $9 million in REF money. The local utility companies or local governments would have never been able to procure such large amount of money without these grants. Those projects are both considered successful because of the cost savings to the local government in diesel offset and because of the price stabilization of electricity. The actual price of electricity did not decrease significantly after these projects, but the price is more stable and no longer relies so heavily on uncontrollable fluctuations in the price of fuel. All that being noted, a real evaluation can be made.

The NPV cost of the proposed Kiana/Noorvik wind farm is $13.8 million, with a NPV cost savings from diesel offset of $2 million, making the net investment value $11.8 million. However, the up-front costs that would need to be covered in a grant would still be $13+ million. For the year of 2016, only $4 million is made available through the REF. That budgetary amount for the fund is not currently expected to grow through the end year of 2022. This wind farm project would be a multi-year project, so not all $13 million would need to be funded the first year. Most of these projects have a 4-6 year process from feasibility through commissioning. That would mean that between $2 million and $3.5 million a year would need to be appropriated through the REF.

Final Recommendation

It is estimated that $13.8 million will need to be appropriated through various grant and funding sources in order to complete the proposed Noorvik/Kiana wind farm. With the current funding sources shrinking in recent years, it is not likely that this money will be readily available in the near future. This project would greatly reduce diesel fuel needs in Noorvik and Kiana over the next 20 years, and would stabilize the price of electricity, and is feasible. However, it is unlikely that the money would be available to invest in this project at this time.

With deep regrets, it is the recommendation of this Capstone project that a wind farm in the Noorvik and Kiana area of the Kobuk River Valley is not a financially realistic option. Until further funds are made available, it is suggested that all but planning be put on hold. If grant funding can be acquired, it is suggested that further study, either updated wind analysis or geotechnical, be conducted.

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Appendices

Appendix A: Project management plan

Appendix B: Research data – estimating costs

Appendix C: Final presentation

Appendix D: Project Charter

Appendix E: Sponsor Letter

Appendix F: Project Schedule

Appendix G: Lessons learned

PROJECT MANAGEMENT PLAN

WIND FARM FEASIBILITY AND COST ANALYSIS
KOBUK RIVER VALLEY, NOORVIK AND KIANA

CORY SMITH
UAA PM686A

INITIAL DRAFT
11/20/15

FINAL REVISED
4/8/16

Project Management Plan Change Log

- 11/6/15
  - Add abstract to introduction
  - Edit Introduction
  - Add risk register
  - Add project objectives
  - Add product objectives
  - Add product scope
  - Add communications matrix
  - Edit change management plan – Add change tracking log
- 11/10/15
  - Milestone schedule updated
  - Add Stakeholder Register
  - Edit/Add to quality management plan
  - Edit Project Scope
- 11/15/15
  - Add stakeholder management plan
  - Update project scope
  - Update product scope
- 11/20/15
  - Formatting

- 1/20/16
  - Abstract and scope change
  - Risk register update
  - Add to change management plan
- 2/23/16
  - Abstract and scope change
- 3/18/16
  - Abstract and scope change
- 4/1/16
  - Final edits
  - Abstract change
  - Update project schedule
  - Update change log
  - Update risk register

TABLE OF CONTENTS

INTRODUCTION AND ABSTRACT

Western Alaska villages have incredibly high energy costs due to being off the road system. They rely upon the delivery of fuel by air cargo or barge cargo services for their diesel power plants. This is a particularly costly operation, and fuel prices delivered by this method are typically double, or even triple, the national average. In turn, this results in monthly electricity bills of $500/month or more for a typical household in the winter, which most families in this impoverished region can't afford. The Northwest Arctic Borough (NWAB) has some of the highest cost averages of Western Alaska, due to its extreme remoteness and very limited barging capabilities.

This Capstone project will involve researching the high energy costs in Western Alaska, with special attention to the NWAB, compared to both Alaskan and national averages; and, will research the costs of planning, construction, and operations of wind farms in Western Alaska. The project will enlist various research methods, including literary research, interviews, estimating, and cost analysis tools. It will present a cost analysis of designing, constructing, and maintaining a wind farms vs. traditional diesel generated costs. Lastly, it will provide a recommendation to whether a wind farm in the Kobuk River Valley is a worthwhile endeavor.

The final project deliverable will be a research paper and recommendation intended to be used by stakeholders in the energy industry. It will take into consideration initial investment costs, operations and maintenance costs, current subsidies, and any potential long term cost savings.

PROJECT OBJECTIVES

The objective of this project is to lower energy costs in areas of Western Alaska by allowing stakeholders in the energy industry to make informed decisions on investing in the development of renewable energy sources. A simple, yet effective cost analysis will be created and then used to give a recommendation, which will be formulated into a formal paper explaining the basis of the recommendation – whether an investment in a wind farm in the Kobuk Valley is a worthwhile endeavor.

PROJECT MANAGEMENT APPROACH

The project team will consist of the project manager, the project sponsor, and three committee members, including one advisor.

Cory Smith is the Project Manager and is ultimately responsible for the success of the project. He will direct the planning and execution of the project. He will have authority to make changes to any of the management plans, and will be responsible for developing all the project

deliverables. He will coordinate with the project team and other stakeholders, and will provide updates and information to the project sponsor. He will also be responsible for all the research and conducting the surveys and interviews.

The project sponsor is Bernie Smith, who will oversee the project and provide general recommendations to the project direction. The project advisor is LuAnn Piccard, who has the authority to make changes to the project plan. The other two committee members, Roger Hull and Steven Hatter, will review the project deliverables and provide comments or change initiatives.

PROJECT SCOPE

Introduction:

The scope of this project is three-fold: literary research, a feasibility analysis of the wind potential in the Kobuk Valley, and a cost analysis of developing, constructing, and operating a wind farm in this region. The research consists of using the consortium library and other internet based searches to find articles that relate to energy costs in Alaska and renewable energy. The research will look for previous studies done on costs of initiating renewable energy projects, primarily of wind farms. At least ten articles will be found during the initial research phase to create a baseline of data for the survey questions to relate to. At this point in the project, it is expected that scope will change slightly, based on the research. It is important the change management plan and change tracking log process is used.

The survey questions will then be developed. The survey will consist of fifteen questions that are intended to find data not found in the research. The survey will be given to at least ten stakeholders. Then, interview questions will be created, based on these findings, which will provide final input for the data collection. At this point, all of the collected data will be analyzed a feasibility and cost analysis will be used to create a recommendation for this region.

The project will be conducted in two phases: the planning phase, and the execution phase. The planning phase will include the development of this project management plan, a twenty minute presentation on this plan, and a 2-3 page lessons learned. The execution phase will involve the research, and development of the final paper and recommendation. It will produce both a research report and a power point presentation. It will also consist of a final, fully integrated document with all of the reports, data, and other applicable appendices.

Project Deliverables:

- A fully developed project management plan
- A twenty minute long power point presentation of the project plan
- A cost estimating tool
- A thirty five page research paper, with additional appendices of survey/interview/research results
- A thirty minute long power point presentation of the results of the research project, results and recommendation
- A lessons learned narrative

Project Acceptance Criteria:
All of the deliverables on this project must meet the standards outlined in the UAA PM686 class syllabus. They must also meet the pre-determined schedule of the project (see milestone baseline). The cost estimating tool must be both useful and easy to use for the average end user. The final report and recommendation must be informative, properly cited, and properly formatted per industry standard.

Project Exclusions:
This project will not include any monitoring and control phase, after execution. Once the cost estimating tool is created and some recommendations are made, no follow up action is included.

Project Constraints:
The project must be completed within two semesters. Project surveys and interviews cannot start until IRB submittal is accepted by UAA conformance department. Execution phase of the project can not begin until the PM Plan is complete. Project resources are limited to the project manager and his team; no outside labor resources may be used.

Project Assumptions:
It is assumed that enough data is available through various research methods to allow for the development of a cost estimating tool. It's believed that at least fifty percent of survey takers will respond. There are no anticipated major conflicts in the project staffs' personal lives that will interfere with the progress of the project.

PRODUCT SCOPE

The final product will be a cost analysis of the wind farm project, as outlined below. This will be utilized by decision makers for funding or initial budgetary purposes. The tool will use data from past projects or information gathered from industry experts. The final output will include a final cost and recommendation.

Cost Analysis

Planning Costs + Construction Costs + M & O Costs (NPV) – Diesel Offset (NPV) = Total Project Cost

Planning costs will include the following:

- Finance charges (interest payments)
- Project management
- Design
    - Wind analysis
    - Geotechnical survey

  - Construction design and engineering

Construction costs will include:

- Installation of transmission lines
- Procurement and installation of wind turbines
  - To include site mobilization and site prep
- System upgrades

Maintenance and Operation costs will include:

- Commissioning of new system
- Initial training
- Equipment upgrades during operation
- General maintenance and troubleshooting

PROJECT SCOPE MANAGEMENT PLAN

Introduction:
The project manager is responsible for project scope management. The project scope is outlined above in the project scope section of this project management plan. The scope is further described by the WBS work packages and milestone list. Scope will quantified by the milestone checklist. Any and all change in the scope will managed as described in the change management plan. The project advisor will have the authority for accepting the final project deliverable.

Collect Requirements/Verify Scope:
The project charter will be used to determine the baseline scope of the project. The project manager will then use the stakeholder register to determine stakeholders' needs in this project. He will also use his knowledge of the industry to determine what kind of product will be useful. Research, surveys, and interviews will be used to collect more information that can be evaluated to change the scope. Throughout the project, the project manager will evaluate the scope to ensure there is no scope creep and that any changes are correctly documented. All project documents should be checked regularly by the project manager to verify the project scope is being maintained.

Scope Measurement:
The WBS will be used primarily to measure and monitor scope. It is expected that changes in the scope will occur, so these changes must be shown on the WBS. Once a month, the project manager will check the WBS vs. the scope of the project and will analyze if changes are being

documented correctly. If more than three changes are undocumented, the project is put into a red status, and all project documents must be reviewed and updated. This will be shown in the change tracking log.

MILESTONE LIST

The below chart lists the major milestones for this Capstone project. It is divided into milestones for the planning phase (PP) and the execution phase (EP)

Milestone	Description	Date
PP PPM #1	Project Charter, Prelim schedule and WBS, Stakeholder Analysis, Support letter from sponsor, Knowledge Area Selection, 200 word abstract, Prelim GSP	9/11/15
PP PPM #2	Updated schedule and WBS, Scope Statement, KA update with metrics, Research Sources and Key Words, Prelim Research Methods, Requirements Documentation, IRB Account Established	10/2/15
PP PPM #3	Updated schedule and WBS, Project management plan draft, revised abstract, Developed research methods, expected outcomes, KA update, IRB training complete	10/23/15
1st "go/no-go" decision	Advisor will determine if the project will continue, based on progress	10/28/15
PP PPM #4	Research Instruments and Analysis, Final IRB submittal, Final Draft of PM Plan, Refined project deliverables, KA Update, KA for execution phase	11/20/15
2nd "go/no-go" decision	Advisor will determine if the project will continue, based on progress	11/25/15
PP Final Presentation	20 minute powerpoint presentation of project management plan and Capstone project	12/1/15
EP Send out Survey	Complete survey questions and send out survey to 12-15 stakeholders	1/20/16
EP Survey Complete	All surveys have been completed, and data compiled	2/10/16
EP Interview Complete	All interviews have been completed, and data compiled	3/13/16
EP Research Report	Final research report complete, with appendices	4/8/16
EP Report Presentation	Final presentation of report	4/18/16

SCHEDULE BASELINE AND WORK BREAKDOWN STRUCTURE

This project has a relatively small deliverable package, with limited work packages. Each milestone in the schedule involves only 4-8 deliverables, and they are mostly non-linear (e.g. very limited finish-start task links). Movement in the schedule between the milestones is non-consequential to the overall schedule, so the critical path moves along the milestones only.

The WBS contains no items of work that are longer than 21 days. No hours of work are built into the WBS or schedule, as the project manager is the only work resource. WBS work packages may only be changed through the change management plan, however flow of the schedule may change as needed.

The schedule and WBS are included as an appendix to this PM Plan.

STAKEHOLDER MANAGEMENT PLAN

Introduction:
The project manager will be responsible for managing stakeholders. It will be his role to create and routinely update the stakeholder register. Certain stakeholders may change interest throughout the execution phase of the project. For instance, during the survey and interview phase of the project, some of the stakeholders involved in that research will become high interest, as they will be immediately involved.

Stakeholder Identification:
The project manager will use his expert knowledge to create a stakeholder register (see below). Each stakeholder's relationship to the project will be listed, it will be determined if they are internal or external to the project, and their power and interest will be rated (on a 1-3 scale, 3 being high). Their power and interest will be used to determine a stakeholder priority (power * interest), which will then be shown on a power/interest matrix for quick reference.

Stakeholder Management:
The stakeholder priority score will be used to pay close attention to certain stakeholders. During the planning phase, any stakeholder with a score 6 or above will be communicated with regularly (see communications matrix.) During the execution phase, all stakeholders with a score of 3 or above will be routinely evaluated to for change in their interest or power. If their priority score rises above 3 during that phase of the project, communication will start with them.

STAKEHOLDER REGISTER

	Stakeholder Register			3=high, 1=low	3=high, 1=low	
ID #	Stakeholders	Relationship/Role	Internal / External	Influence/Power (high/med/low)	Interest (high/med/low)	Stakeholder Priority (power * interest)
1	Project Manager	Manage all aspects of the project, ultimately responsible for the success of the project	Internal	3	3	9
2	Project Sponsor	oversee	Internal	2	1	2
3	Advisory Board	Oversee project progress, comment on deliverables	Internal	3	2	6
4	PM686A Instructors	Oversee project progress, grade student, assist in progress	Internal	3	3	9
5	Community Members	Impacted by the energy costs	External	1	3	3
6	Local Entities (village councils, etc)	Impacted by the energy costs, effects on budgets, possible research contacts	External	1	3	3
7	Native Corporations (NANA/Calista/BSNC)	possible research contacts, information on regional effects of costs	External	1	2	2
8	Local Business (grocery stores)	effects on pricing, research contacts	External	1	2	2
9	Fuel Providers (Crowley, etc)	research contacts, data on energy costs	External	1	3	3
10	Air Cargo Providers (Everts/NAC/Ryan Air)	possible research contacts	External	1	3	3
11	Air Carriers (AK Air/Ravn/Grant/Bering Air)	possible research contacts	External	1	2	2
12	Energry Providers (AVEC/AEA)	survey contacts, data on energy costs	External	1	3	3
13	State of AK Entities (DOT/DNR/DEC)	possible research contacts, data on energy costs or capital budgets, final deliverable recipient	External	1	2	2

14	Housing Authorities (NIHA, etc)	possible research contacts	External	1	2	2
15	School Organizations (LYSD/LKSD)	possible research contacts	External	1	2	2
16	Federal Entities (BIA/EPA/USDA)	final deliverable recipient	External	1	1	1
17	Sport Fisher/Hunters	possible contacts for variable research	External	1	1	1

POWER INTEREST GRID

Power /Interest Grid		Interest		
		1	2	3
Power	1	16 17	7 8 11 13 14 15	5 6 9 10 12
	2	2		
	3		3	1 4

The above power interest grid shows that the most attention should be given to stakeholders 1, 3, and 4. It should be noted that this power interest grid may change during the different phases of the project.

CHANGE MANAGEMENT PLAN

Introduction:

Changes in this Capstone project may be initiated by any of the members of the project team, through an informal change request. This project relies heavily on information gathering, compilation of data, and results from surveys and interviews. It is essential that enough information can be collected to develop an end product. As such, it is expected that multiple changes in scope will occur. Change management is ultimately the responsibility of the project manager.

Change Process:
This change request can be in the form of an email, telephone call, or in comments made to project progress milestone (PPM) deliverables. The project manager will analyze the change request, and will either approve or disapprove of the change, depending on the extent and area of the change. All minor changes can be approved by the project manager, which is to include changes to any management plan, the scope, or minor adjustments in the PPM deliverables. Any major changes must be approved by the project advisor. A major change is defined as any variance in a project milestone and major delay in the schedule, or any change in the final project deliverable. All changes are subject to review by any or all of the project team.

Change Monitoring and Control:
These changes will be tracked in the following change tracking chart.

Change #	Date	Description of need of change and change request	Project documents to update	Effects on project / comments
Change 1 (example)	xx/xx/xxxx	Surveyee #8 does not return survey. Send out survey to additional stakeholder	Project Schedule	Already built into schedule, should have little to no effect.

Additionally, a change log will be maintained for revisions of any plans or other project documents. It will not be as detailed as above, but will only show dates of revisions.

COMMUNICATIONS MANAGEMENT PLAN

Introduction:
Generally, communications will be directed by the project manager. Most communications will be initiated by the project manager and will involve responses from other project team members. The project advisor may also initiate communications, but only to the project manager.

Communication Means:
In most cases, the communications will be done through email, however, phone calls are a secondary, acceptable method. It is expected that all emails are to be answered within 10 working days. Voice mails shall be returned within 3 business days, but are to be used only when timing is more critical. UAA Blackboard shall be another forum for posting deliverables and making comments to these deliverables. All team members, with exception to the project sponsor, have access to Blackboard, and should access the “collaboration folder” for the project manager at least once a month.

Expectations:
Notice of project deliverables being completed will be given to the project team members from the project manager once every 3 weeks. It is expected that some feedback from the project team

members will be communicated back to the manager. At least once a month, the project manager will email each project team member asking for specific advice about particular deliverables. The responses will be integrated into the project deliverables.

Standards:
Email and phone communication may be conducted informally, but still with a level of professionalism, such as might be used in an office breakroom.

Project team directory for all communications is:

Name	Title	E mail	Phone
Bernie Smith	Project Sponsor	bernies49@gmail.com	N/A
Cory Smith	Project Manager (PM)	Cwsmith6@uaa.alaska.edu	907-360-7616
LuAnn Piccard	Project Advisor	Lpiccard2@uaa.alaska.edu	907-786-1917
Roger Hull	Committee Member (CM)	rkhull@uaa.alaska.edu	N/A
Steve Hatter	Committee Member (CM)	steve.hatter@alaska.gov	907-465-3906

Execution Phase Communication:
The other form of communication will be the survey and interviews. The survey questions should be simple and direct. Most of the questions will involve yes/no or 1-5 type questions, however, a few open-ended questions on the survey will be required to allow for unanticipated answers. The survey questions will be created after the initial literary research phase of the project, so that they may be tailored to fill voids in research data. The surveys will be given to stakeholders early in the execution phase, to meet the milestone schedule. This will allow for enough time to analyze the data received.

The interview will be conducted face to face by the PM with the interviewee. The PM should use listening skills to allow for the most information to be told. It is important that the PM allows for enough time after each question to let the interviewee adequately respond. These interviews should last between 45 minutes and 1 hour.

A communications matrix is shown below. It summarizes the communications plan, and should be used by the project team to ensure compliance with the communications plan.

COMMUNICATIONS MATRIX

Description	Responsible Person	Other Parties	Purpose	Frequency / Iterations	Communication Means	Internal / External	Other Comments
Deliverable Comments	PM, Advisor	Committee Members	Provide feedback to	Every 3-4 weeks	Email and Blackboard	Internal	

		(CM)	enhance project deliverables				
Status Update	PM	Classmates	A check on project schedule	Every 3-4 weeks	Blackboard, present in class	Internal	3 minute goal
Project Meeting	PM	Advisor	Quality control on project	Once a semester	Face to Face meeting	Internal	Should be about half to 75% through semester
Surveys	PM	Surveyee	Gather information for project	15 surveys sent, 3-5 secondary surveys sent. Feb. '16	Email or mail	External	If response don't come, send out new surveys to other stakeholders
Interviews	PM	Interviewee	Gather more in-depth information for project	2-3 interviews. March '16.	Face to Face meeting	External	Expect 45mins to 1 hr for interview.

COST MANAGEMENT PLAN

This project is an educational, research project that does not include a budget, as there are no anticipated real costs. Therefore a cost management plan is not included as a part of this project management plan.

PROCUREMENT MANAGEMENT PLAN

This project will not include any procurement of materials. Therefore a procurement management plan is not included as a part of this project management plan.

SCHEDULE MANAGEMENT PLAN

The project schedule will be created using Microsoft Project 2010. Resources will not be loaded into the project, as there is only one resource (project manager time.) Each activity will be broken into work segments no longer than thirty days. Each activity will become a work package in the WBS. As mentioned above in the schedule baseline section of this project management plan, the milestones are the functioning critical path of the schedule. Each milestone shall not be delayed without having an overall effect on the entire schedule. Each individual work package may slide or move ahead without having a total effect on the project (i.e. slack or lag.)

The milestone schedule will be pre-determined by the project advisor, but it is the responsibility of the project manager to maintain the milestones. The rest of the schedule, or work packages, will be determined by and the responsibility of the project manager. Each team member, however must abide by the communication plan schedule requirements, for commenting, responding, or other activities. The project manager will determine the duration of each package, and is allowed to move the packages order and make small changes to the durations. Any crashing of the project may be completed by the project manager by utilizing additional "overtime" hours not originally intended for the project. The project advisor and other team members will be responsible for reviewing the schedule and making comments, but may not change it.

QUALITY MANAGEMENT PLAN

Introduction:
The project manager is ultimately responsible for the quality of all project deliverables. Other team members are responsible for quality audits and reviews. Quality requirements are pre-determined by a course syllabus. It is the responsibility of the project manager to use expert knowledge of the project management book of knowledge in determining quality.

Quality Metrics:
Each deliverable has a list of measures from this syllabus that will be used to determine final product quality (see quality baseline below). It is the responsibility of the project manager to understand these metrics and ensure final project deliverables meet the pre-determined standards. Course metrics based on a standard A, B, C, Fail system will be used as the final determination of quality.

Quality Control:
The project manager will check work regularly to ensure proper formatting (PMI and APA), spelling, grammar, and consistency among documents. Microsoft Office programs will be used in producing all deliverables, and have a built in grammar and spelling check system which will be used throughout the project.

Quality Audit:
The committee members will periodically audit the quality of the deliverables, and make suggestions to the project manager if quality is lacking. The project advisor will grade all deliverables, which will be the final determination of quality.

RISK MANAGEMENT PLAN

Risks will be analyzed by the project manager, and will include both internal and external risks. The project manager will make a list of risks using expert judgment as the basis of identifying risks, will evaluate the disruptive impact to the project and will evaluate the likelihood of the risk. Qualitative risk analysis will be used creating a probability and impact matrix. This metric will be used to find the top three risks or threats. These three threats will be further evaluated to decide if one of the four strategies for negative risks can be used (avoid, transfer, mitigate, or

accept). Transfer is not an option on this project due to the limited resources. The project manager will then develop a strategy to handle the threats based on the analysis. Towards the end of the project, the effect of these threats, the strategies to handle them, and lessons learned will be documented.

RISK REGISTER

RISK INDEX

Score	Color	Definition	Action Required
(1-7)	Green	Minimal Risk	Mitigate or Accept
(8-14)	Yellow	Medium Risk	Mitigate, monitor closely
(15-25)	Red	Major Risk	Avoid, Mitigate, react immediately

Risk #	Risk Description	Probability (1-5)	Impact (1-5)	RISK SCORE	Response	Action By	Type of Action	Documentation
1	PM - Minor unanticipated schedule event (new work deadlines, unplanned travel, etc)	4	2	8	Crash Scheduled tasks, rearrange schedule	PM	Mitigate or Accept	Update Schedule
2	PM - Major unexpected event that causes unavailability of PM (car crash, etc)	1	5	5	Delay Project to next semester	PM, advisor	Accept	Update Schedule
3	Not enough data in research	2	5	10	change scope to relate to information found	PM	Mitigate	Update Scope mgmt plan, scope statement, charter
4	Surveyees do not respond to survey	5	2	10	Send out survey to additional stakeholders	PM	Mitigate	Update project documents
5	Not enough data from surveys	3	4	12	Submit further surveys, add questions to interviews	PM	Mitigate	Update project documents
6	Compiled research data is unuseable	3	5	15	re-evaluate scope, adjust scope to fit data, adjust product to fit data, gather more research data	PM	Mitigate or Avoid	Update all project documents
7	Interview subjects can't find time for interview, or give very short/non useable responses	1	5	5	Find other stakeholders to interview, lose opportunity for data	PM	Mitigate or accept	Update stakeholder register and plan, update scope statement
8	Scope Creep	5	3	15	look to change management plan, update project documents	PM	Avoid or mitigate	Update project documents, as needed

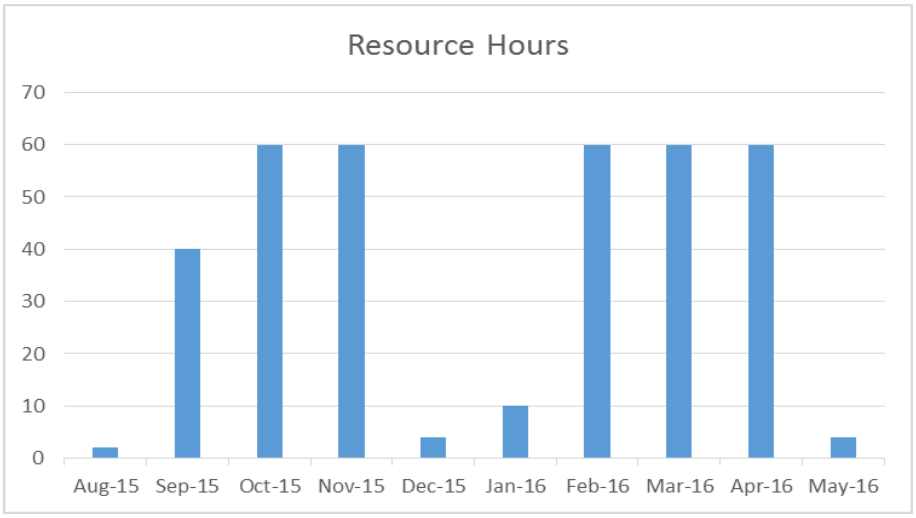
9	Project Team Members not communicating per plan	5	3	**15**	re-evaluate team members	PM	Mitigate	Update project documents, including Graduate Plan
10	Review comments for deliverables are not timely or useful	4	2	**8**	Communicate with team members per communications plan	PM, Com. Members	Accept or mitigate	record communications in log

STAFFING MANAGEMENT PLAN

The staff for this project includes the project manager, project advisor, project sponsor, and project committee members. However, the responsibility for all of the work is solely that of the project manager. Due to the relatively limited staffing management needs, a staffing management plan is not included in the project management plan.

RESOURCE CALENDAR

This project is schedule to last two semesters, or approximately eight months with a one month winter shutdown. There is only one resource on the project, the work hours of the project manager. The project manager will work on the project between ten and twenty hours a week. If needed, the project manager is allowed to work overtime (or any hours additional to twenty) to crash the project. A resource calendar is included below.



COST BASELINE

There are no costs associated with this project, therefore a cost baseline is not included as a part of the project management plan.

QUALITY BASELINE

The quality baseline for this project is based on a predetermined course syllabus. The acceptable quality levels are 90%, with the exception of the oral presentation, which only requires an 80% quality score, in order for the project to be successful. A quality baseline matrix is below.

Item	Acceptable Level	Metric
Project Progress Milestone Deliverables	Score 90% or higher	34 points PPM 1 – 4 points PPM 2 – 8 points PPM 3 – 10 points PPM 4 – 12 points
Knowledge Area Focus and Application/Measurement	Score 90% or higher	4 points All milestones, 1 point each
Oral Presentation	Score 80% or higher	20 points
Project Management Plan	Score 90% or higher	36 points Quality of content – 12 points Research of deliverables – 12 points Quality of written material – 12 points
Total	Score 90% or higher	100 points

SPONSOR ACCEPTANCE

Approved by the Project Sponsor:

_____ Date: 11.19.15

Bernie Smith
Owner, Energy For Alaska

APPENDICES

- Requirements Traceability Matrix
- Schedule
- WBS

*all figures in thousands

Project	Year Started	Year complete	TOTAL	Development and planning: TOTAL	Finance(int.)	PM	Wind Analysis	Feasibility	geotechnical	Permit	Eng. Design	Construction: TOTAL	Turbines (delivered)	Site prep/construction	Transmission	System Integration	O & M: TOTAL	Commissioning / Training	Equip. Upgrades
Buckland	2008	2015	$6,688	**$732**	insig. - REF	in kind (NANA)	$97	$104	$161	$28	$342	**$5,956**	delivered (992k x2) $1,984	$2,852	$280 / mile x4 $1,120				
Deering	2008	2015	$2,700		insig. - REF	in kind (NANA)	$101								$266/mile x 1.5 $400	$240			
Noorvik	2008	n/a	$1,000		insig. - REF	in kind (NANA)													
Kasigluk		2006										**$3,275**							
Shungnak (conceptual)		n/a	$5,600					$85											
interview results							~ $100	$150 - 200	$75 - 150	$25 - 50	$300 -500	$5000 - 8000	$300 - 600 (NREL) $1200 - 1700 (Strom) $1000 -1500 (AEA)		$200-2000/mile	$100 - 150 (new system) $250 - 500 (old system)		~ $50	$50 -150

NOORVIK / KIANA				Development and planning								Construction					O & M		
Estimating Method					analagous	analagous	3 point	3 point	3 point	3 point	3point		3point	analagous	analagous	analagous		Exp. Know.	Exp. Know.
Best case (a)							$97	$85	$75	$25	$300		$600						
Most likely (m)							$100	$175	$161	$28	$450		$1,000						
Worse case (b)							$101	$200	$150	$50	$500		$1,700						
3 point est. [(a+4m+b)/6]			**$13,839**	**$1,039**			$100	~~$164~~	~~$145~~	$31	$433	**$12,600**	$1,050				**$200**		
Other method, Est.					$0	$0	$25*		$550					3000**	$300	$600		$50	$150
							*initial wind study complete		3point used for site, plus 6 times Buckland for transmission line				per ea. turbine @ 4 ea - $4200	**included in turbine	per mile @ 26 miles - $7800	upgrades to 2 systems			

Wind Farm Feasibility and Cost Analysis: Kobuk River Valley

CORY SMITH, PMP

UAA, SPRING 2016

Cory Smith, PMP

- Project Manager with Ridge Contracting, Inc – 6 years
  - Heavy Civil Construction
  - Mostly Western Alaska
  - Barging and Logistics
  - Ambler Airport, Kobuk River
  - HIGH COSTS FOR EVERYTHING!

RIDGE CONTRACTING, INC.

WESTERN ALASKA

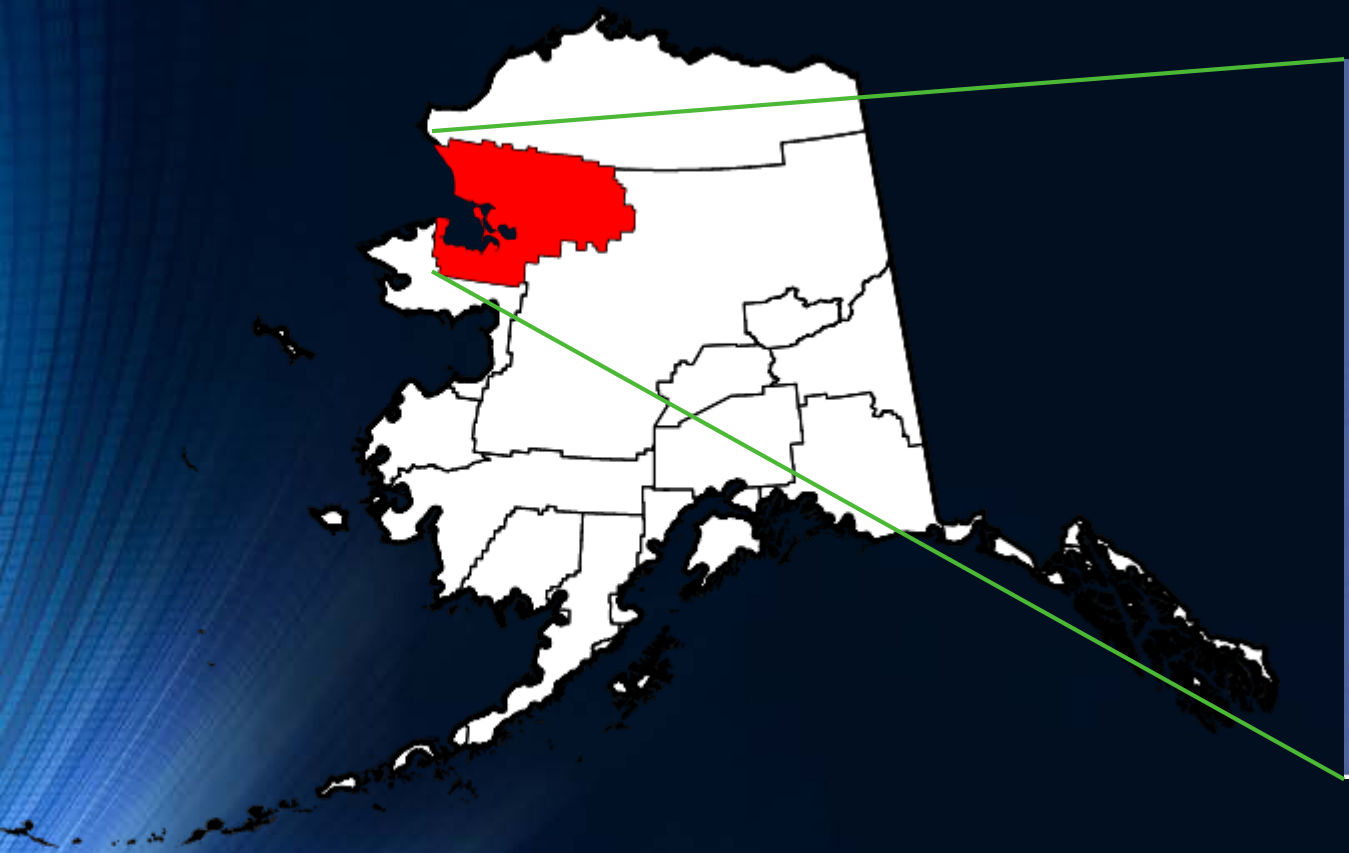
KOBUK RIVER VALLEY

- Remote
- Off the road system
- Off the grid

- $6-$8/gallon – fuel
- $300 - $500/month – electricity
  - Single family home

- Problem:
  - High Cost of Energy
    - $0.73/Kwh average
  - Reliance on Diesel Fuel
    - Instability of market, logistics
- Solution
  - Find reliable, cost effective source of energy

Northwest Arctic Borough (NWAB)



KOBUK RIVER VALLEY

- NOORVIK
- KIANA

Wind Farms

- Renewable
- Environmentally friendly
- Diesel offset
- Lower cost of energy
- Available grant funding

- Northwind 100 Turbine

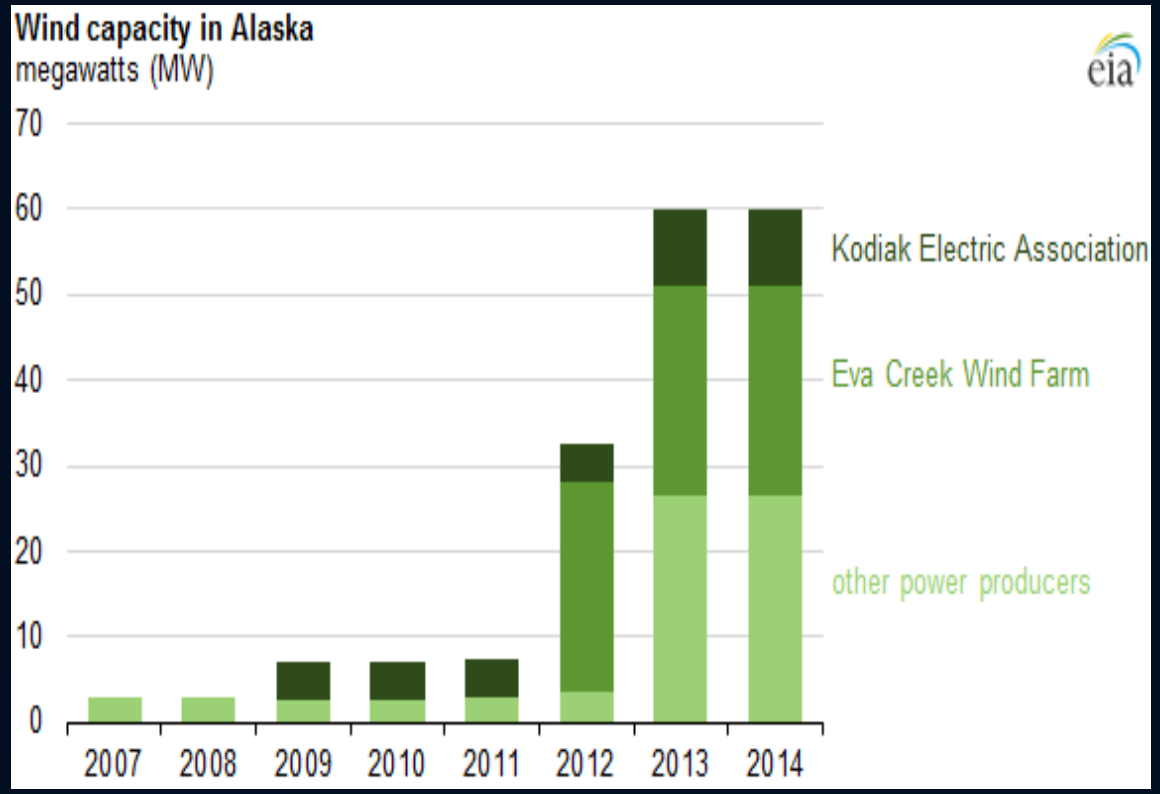
CAPSTONE PROJECT

- Planning Phase
  - 686A, Fall 2015
  - Scope of Project
  - Project Management Plan
- Execution Phase
  - 686B, Spring 2016
  - Changes, Changes, Changes
    - 20+ changes on project
  - Surveys vs. Interviews

Change #	Date	Description of need of change and change request	Project documents to update	Effects on project / comments
1	1/12/2016	Original project scope is too broad. Also, existing tool has been created at a national level, and is not user friendly or effective. Change scope to cost analysis of new wind farm in Kobuk River (see scope plan for more detail)	Project Scope, Product Scope, Project Schedule, Survey questions, RTM	Some change in scope was already noted in the risk management plan. This should only affect the length of the literary research phase of the project.
2	1/25/2016	Change Management Plan changed to delete change request for scope changes. It would be too time consuming to wait on approval on all changes	Change Management Plan	Help expedite the change process, which will allow for previous schedule slips to be corrected.
3	1/25/2016	Not a single survey has been returned. It does not appear that the data received from this scope of the project will be useful. Additional interviews will be added to the scope to gather more information	Scope, schedule, stakeholder register	This will affect the project schedule, as more interviews will need to be added. It will also affect the end results of analyzing data, as the data source will now be different.
4	1/25/2016	Added new committee member, update stakeholder information	communications mgmt plan, stakeholder register	No major effect on project.
5	1/26/2016	Need to revise schedule in order to adjust for change in scope. Also will be revising WBS.	Schedue, WBS	Crash some items in project in order to complete on time (such as 2nd phase of research)
6	2/13/2016	Project abstract needs to be changed to include new scope of work	Update project abstract, update intro/abstract of PM plan	No major effect on project.

CAPSTONE PROJECT, cont.

- Literary Research
  - Lack of data – relatively new in Alaska
- Survey
  - ZERO returned surveys!!!
- Interviews
  - Best source for information
  - Program Manager, Wind and EETF – AEA
  - Energy Manager – NWAB
  - Director of Alternative Energy - NANA



CAPSTONE PROJECT, cont.

- General research
- Feasibility analysis
- Cost analysis
  - *Planning Costs + Construction Costs + M & O Costs (NPV) – Diesel Offset (NPV) = Total Project Cost*
- Recommendation (Final Product)

Power Cost Equalization Subsidy

- Mitigates high cost of energy in rural Alaska
- Pays first 500 Kwh of energy use per month
- Residential only
- 2013 – 2014
  - Kiana - $289,000, or $0.45/Kwh
  - Noorvik - $448,000, or $0.45/Kwh
- Goal: pay same rate as Anchorage/Fairbanks average

Renewable Energy Fund

- State grant money for renewable energy projects
- $200+ million since 2008

- $10 million to NWAB in 2009
  - Deering
  - Buckland
  - Noorvik

ALASKA ENERGY AUTHORITY

Wind Energy Potential and Penetration

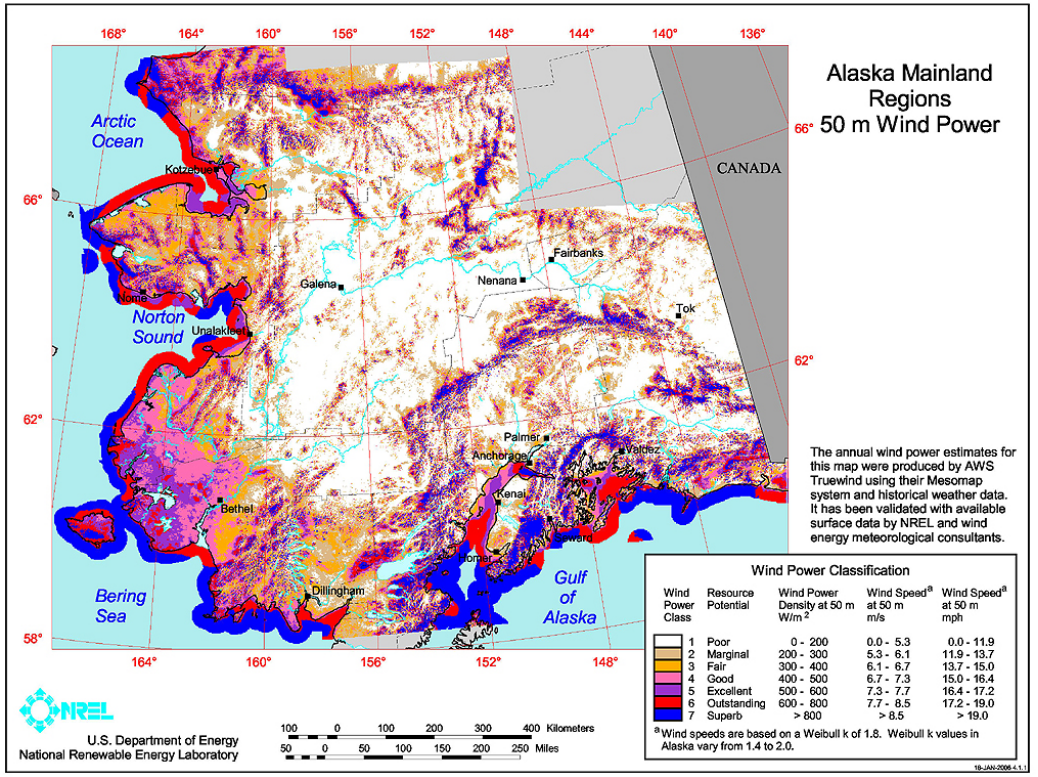
- Class 3: viable
- Wind Penetration
- Medium Penetration
  - 20%-30% offset
- Low Penetration
  - 8%-20% offset

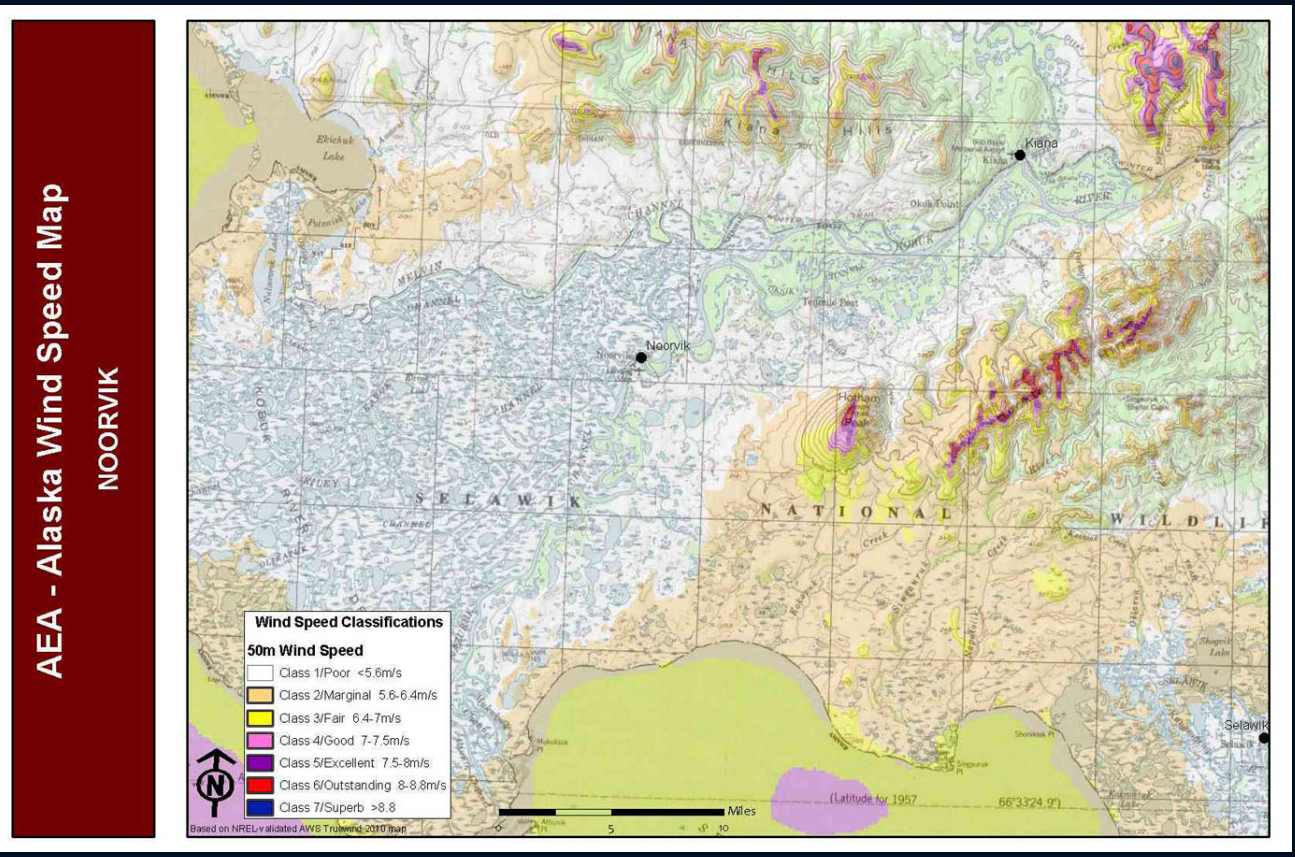
Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m^2	Wind Speed[a] at 50 m m/s	Wind Speed[a] at 50 m mph
1	Poor	0 - 200	0.0 - 6.0	0.0 - 13.4
2	Marginal	200 - 300	6.0 - 6.8	13.4 - 15.2
3	Fair	300 - 400	6.8 - 7.5	15.2 - 16.8
4	Good	400 - 500	7.5 - 8.1	16.8 - 18.1
5	Excellent	500 - 600	8.1 - 8.6	18.1 - 19.3
6	Outstanding	600 - 800	8.6 - 9.5	19.3 - 21.3
7	Superb	> 800	> 9.5	> 21.3

[a] Wind speeds are based on a Weibull k of 2.4 at 500 m elevation.

Feasibility – Kobuk River Valley





Diesel Offset

- Current power plants, diesel power
  - Barged or flown in
- 8-20% offset for low penetration wind system
- Kiana – 140,000 gallons/year
- Noorvik – 160,000 gallons/year

- @ 10%, 30,000 gallons/year – @ $4.5/gal - $2 million offset in 20 years

Estimating for Cost Analysis

- Analogous
  - Deering/Buckland Projects
- Industry Experts
  - Interview information
    - Up to date
    - Known costs
    - Already researched
- Three Point Estimating
  - Best case, Most likely, Worse case

- **Planning costs** :
- Finance charges (interest payments)
- Project management
- Design
  - Wind analysis
  - Geotechnical survey
  - Permitting, Land acquisition
  - Construction design and engineering

- **Construction costs** :
- Installation of transmission lines
- Procurement and installation of wind turbines
  - To include site mobilization and site prep
- System upgrades

- **M&O costs**:
- Commissioning of new system
- Initial training
- Equipment upgrades during operation
- General maintenance and troubleshooting

OVERALL MODEL:

Planning Costs + Construction Costs + M & O Costs (NPV) – Diesel Offset (NPV) = Total Project Cost

Project Planning

- Finance charges (interest payments)
  - Low or near-zero interest on certain grants
- Project management
  - AEA – general contributor
  - NANA – "in-kind"
- Noorvik/Deering/Buckland
  - Awarded $10 mil in 2009
  - $1 mil Noorvik, wind studies

Design

- Wind analysis
  - Determine wind class
  - V3 Energy, LLC
- Geotechnical survey
  - No roads or trail
  - Rigorous terrain
- Permitting, Land acquisition
  - NWAB, Title 9 Permit
  - SWPPP
  - Native allotment or NWAB subsistence land
- Construction design and engineering
  - Engineering firm, lengthy/expensive

Project Construction

- Installation of transmission lines
- Procurement and installation of wind turbines
  - To include site mobilization and site prep

Project Construction, cont.

- System upgrades

- Old diesel power plants
- Lack of storage
- No automatic controls, SCADA

Project Operations

- Commissioning of new system
  - Special manufacturer reps, usually from lower 48
- Initial training
  - Locals
- Equipment upgrades during operation
  - Energy storage
  - Controls
- General maintenance and troubleshooting

- IN ADDITION TO EXISTING SYSTEM ONLY

MODEL:

Planning Costs + Construction Costs + M & O Costs (NPV) – Diesel Offset (NPV) = Total Project Cost

$1,039,000 + $12,600,000 + $200,000 - $2,000,000 = $11,839,000

3-5 year project – $2.5 mil to $4 mil per year funding

Renewable Energy Fund – limited in recent years

$4 mil total estimated 2016

Recommendation

- Wind Energy Potential - YES
- Feasible – YES
- Cost – NO

- Not enough grant money to fund this project, at this time
- Project put on hold with continued research on wind/location

THANK YOU!

Questions or Comments?

*all figures in thousands

					Development and planning							Construction						O & M	
	Year	Year																Commissioning /	Equip.
Project	Started	complete	TOTAL	TOTAL	Finance (int.)	PM	Wind Analysis	Feasibility	geotechnical	Permit	Eng. Design	TOTAL	Turbines (delivered)	Site prep/construction	Transmission	System Integration	TOTAL	Training	Upgrades
													delivered (992k x2)		$280 / mile x4				
Buckland	2008	2015	$6,688	**$732**	insig. - REF	in kind (NANA)	$97	$104	$161	$28	$342	**$5,956**	$1,984	$2,852	$1,120				
															$266/mile x 1.5				
Deering	2008	2015	$2,700		insig. - REF	in kind (NANA)	$101								$400	$240			
Noorvik	2008	n/a	$1,000		insig. - REF	in kind (NANA)													
Kasigluk		2006										**$3,275**							
Shungnak (conceptual)		n/a	$5,600					$85											
interview results							~ $100	$150 - 200	$75 - 150	$25 - 50	$300 -500	$5000 - 8000	$300 - 600 (NREL) $1200 - 1700 (Strom) $1000 -1500 (AEA)		$200-2000/mile	$100 - 150 (new system) $250 - 500 (old system)		~ $50	$50 -150

NOORVIK / KIANA					Development and planning							Construction					O & M	
Estimating Method					analagous	analagous	3 point	3 point	3 point	3 point	3point		3point	analagous	analagous	analagous	Exp. Know.	Exp. Know.
Best case (a)							$97	$85	$75	$25	$300		$600					
Most likely (m)							$100	$175	$161	$28	$450		$1,000					
Worse case (b)							$101	$200	$150	$50	$500		$1,700					
3 point est. [(a+4m+b)/6]			**$13,839**	**$1,039**			$100	~~$164~~	~~$145~~	$31	$433	**$12,600**	$1,050				**$200**		
Other method, Est.					$0	$0	$25*		$550					3000**	$300	$600		$50	$150
							*initial wind study complete		3point used for site, plus 6 times Buckland for transmission line				per ea. turbine @ 4 ea - $4200	**included in turbine	per mile @ 26 miles - $7800	upgrades to 2 systems			

Cory Smith
Capstone Project

Creating a Cost Estimating Tool that Analyzes Costs and Savings in Developing Renewable Energy Sources in Western Alaska

Project Charter

Date Prepared: 11/18/20
Project Owner: Cory Smith

Statement of Work:

This project will include developing a research report on the high costs of energy in Western Alaska, and the potential savings in investment in renewable or alternative energy sources. The project will also have the end product of a cost estimating tool that will be used to provide recommendations on cost saving endeavors.

Project Goal:

The objective of this project is to lower energy costs in areas of Western Alaska by allowing stakeholders in the energy industry to make informed decisions on investing in the development of renewable energy sources. A simple, yet effective cost estimating tool will be created and then used to give recommendations, which will be formulated into a formal paper explaining the basis of the recommendation – whether an initial investment in an alternate energy source is a worthwhile endeavor or not..

Budget:

There will be no anticipated major costs for this project. There will be some minor costs in transportation and in document printing. A project budget is set at $500.

Schedule:

The project will last two semesters during the UAA school year; the planning phase of the project will be during the 2015 fall semester, and the execution phase of the project will be during the 2016 spring semester. The project completion date is May 5th, 2016. Milestones for this project are listed below.

Milestone	Description	Date
PP PPM #1	Project Charter, Prelim schedule and WBS, Stakeholder Analysis, Support letter from sponsor, Knowledge Area Selection, 200 word abstract, Prelim GSP	9/11/15
PP PPM #2	Updated schedule and WBS, Scope Statement, KA update with metrics, Research Sources and Key Words, Prelim Research Methods, Requirements Documentation, IRB Account Established	10/2/15
PP PPM #3	Updated schedule and WBS, Project management plan draft, revised abstract, Developed research methods, expected	10/23/15

	outcomes, KA update, IRB training complete	
1st "go/no-go" decision	Advisor will determine if the project will continue, based on progress	10/28/15
PP PPM #4	Research Instruments and Analysis, Final IRB submittal, Final Draft of PM Plan, Refined project deliverables, KA Update, KA for execution phase	11/20/15
2nd "go/no-go" decision	Advisor will determine if the project will continue, based on progress	11/25/15
PP Final Presentation	20 minute powerpoint presentation of project management plan and Capstone project	12/1/15
EP Send out Survey	Complete survey questions and send out survey to 12-15 stakeholders	1/28/16
EP Survey Complete	All surveys have been completed, and data compiled	3/10/16
EP Interview Complete	All interviews have been completed, and data compiled	3/30/16
EP Research Report	Final research report complete, with appendices	4/30/16
EP Report Presentation	Final presentation of report	5/6/16

Roles and Responsibilities:

Cory Smith is the project manager, and will ultimately be responsible for the successful completion of this project. His responsibilities will be to conduct the planning of the project, to lead the research efforts, to organize the results, and to create the final deliverable. Bernie Smith and Drew McLaughlin are the project sponsors and will ensure that the project is completed within project constraints. LuAnn Piccard will be the project advisor, who will be responsible for reviewing and grading project progress deliverables; Roger Hull and Steve Hatter willl be the committee members; they will be responsible for evaluating progress and offering advice throughout the project.

Constraints:

This project must be completed within two semesters, with final deliverables at the end of the fall and spring semesters. This project is primarily for academic purposes, and has a budget constraint of $500 for consumable items only.

Assumptions:

It is assumed that enough data can be compiled during the relatively short research phase of the project to draw evidence-based conclusions. This data should be readily available if the proper research methods are used. It is assumed that all project sponsors and committee members will remain available to participate in this project through its lifetime.

Risks:

This project is limited to two semesters, and the research will be executed over a short period of time. There is a risk that not enough data will be found in such a short time window. The project is dependent on the project manager for all of the work, so there is also a risk that some unforeseen event occurs, which takes him away from this project.

Project Sponsor:

_____
Bernie Smith
Owner
Energy For Alaska

PROJECT SPONSOR LETTER

To: UAA Capstone Advisory Board
From: Project Sponsor
Subject: UAA Capstone Project for Cory Smith

September 10th, 2015

Greetings,

This letter demonstrates my support for Cory Smith's Capstone project, a part of his masters program at UAA. I will support his creation and implementation of a Project Management Plan, a research project, and a final deliverable.

The proposed project will research energy costs in Western Alaska. It will be completed by the end of the 2016 spring semester.

As of September 10th, 2015, Cory Smith will serve as the project manager for this project. He will ultimately be responsible for the overall success of the project. He will manage daily the project schedule and organize the project activities.

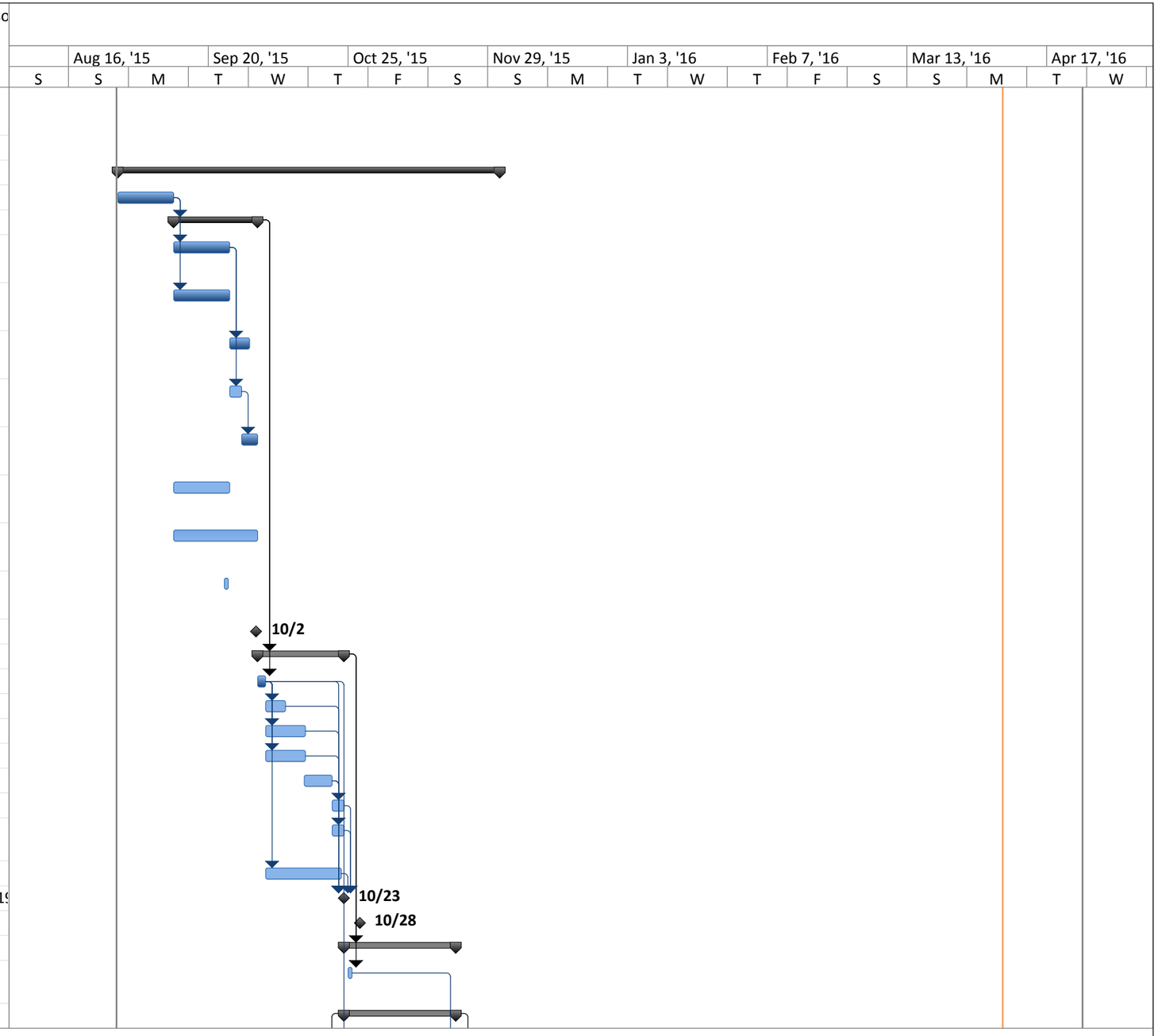
As the project sponsor, I am committed to its success, and will provide necessary support and direction to ensure the project meets the objectives documented in the project management plan.

Sincerely,

Bernie Smith

Project Sponsor
Bernie Smith
Energy For Alaska

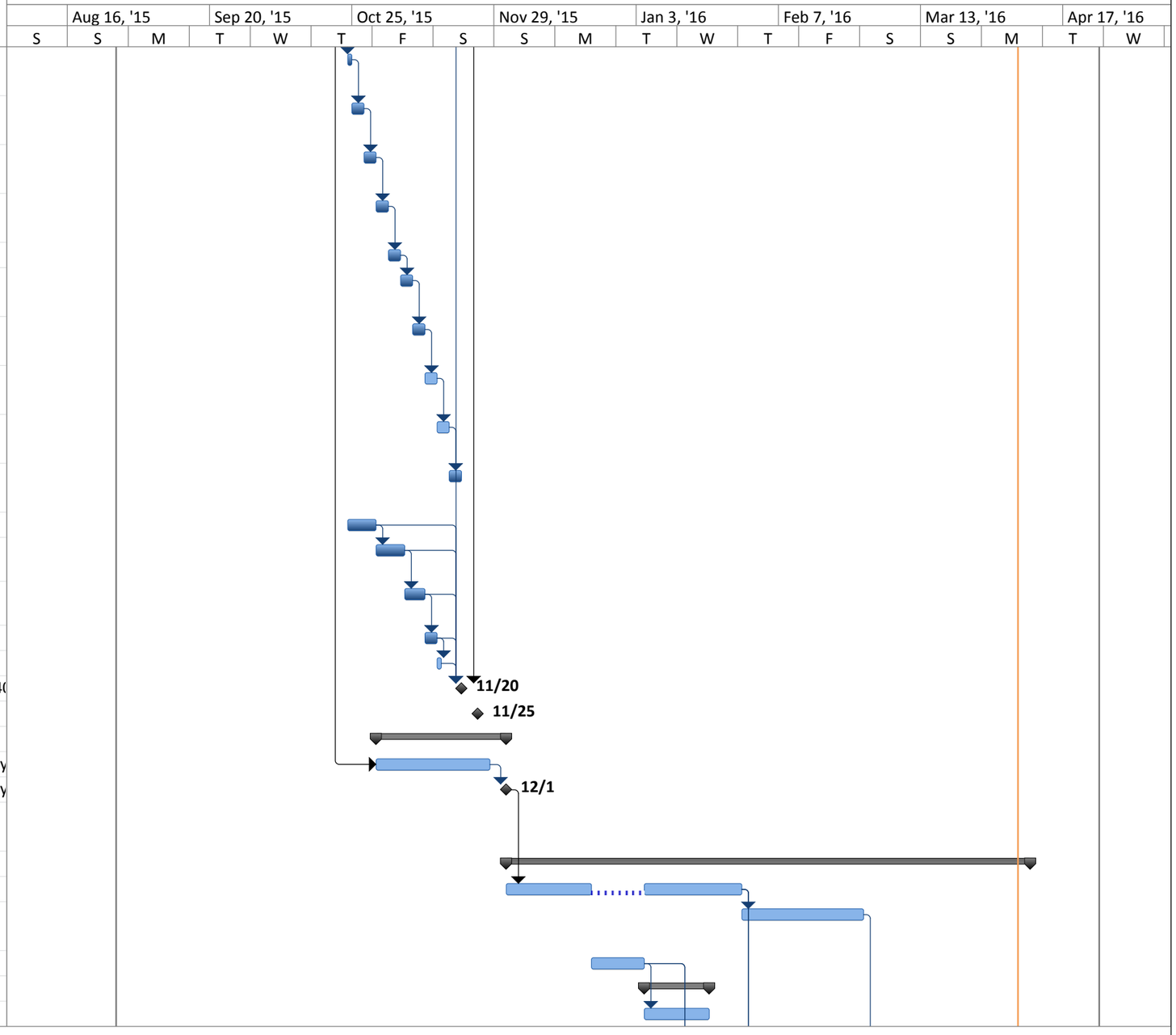
ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		Version 4.8.16 (final)				
2		Cory Smith, PM686B Project Schedule				
3		**Planning Phase (686A - COMPLETE)**	**95.92 days**	**Fri 8/28/15**	**Tue 12/1/15**	
4		PPM 1	14 days	Fri 8/28/15	Fri 9/11/15	
5		**PPM 2**	**21 days**	**Fri 9/11/15**	**Fri 10/2/15**	**4**
6		Update WBS	14 days	Fri 9/11/15	Fri 9/25/15	4
7		Update Schedule	14 days	Fri 9/11/15	Fri 9/25/15	4
8		Develop Scope Statement	5 days	Fri 9/25/15	Wed 9/30/15	6
9		Develop Requirements Documentation	3 days	Fri 9/25/15	Mon 9/28/15	6
10		Develop Table of Contents	4 days	Mon 9/28/15	Fri 10/2/15	9
11		Develop Research Plan	14 days	Fri 9/11/15	Fri 9/25/15	
12		Signed Committee Contract	21 days	Fri 9/11/15	Fri 10/2/15	
13		IRB Account Established	1 day	Thu 9/24/15	Thu 9/24/15	
14		PPM 2 Deliverable	0 days	Fri 10/2/15	Fri 10/2/15	
15		**PPM 3**	**21.92 days**	**Fri 10/2/15**	**Fri 10/23/15**	**5**
16		Revised Abstract	2 days	Fri 10/2/15	Sun 10/4/15	5
17		IRB training completed	5 days	Sun 10/4/15	Fri 10/9/15	16
18		Gantt chart/schedule update	10 days	Sun 10/4/15	Wed 10/14/15	16
19		Knowledge Areas update	10 days	Sun 10/4/15	Wed 10/14/15	16
20		VACATION (known project delay)	7 days	Wed 10/14/15	Tue 10/20/15	
21		Extended Research Methods	3 days	Wed 10/21/15	Fri 10/23/15	20
22		Description of expected products/outcomes of project	3 days	Wed 10/21/15	Fri 10/23/15	20
23		PM Plan rough draft	19 days	Sun 10/4/15	Fri 10/23/15	16
24		PPM 3 Deliverable	0 days	Fri 10/23/15	Fri 10/23/15	16,17,18,19
25		GO/NO-GO Decision	0 days	Wed 10/28/15	Wed 10/28/15	
26		**PPM 4**	**28 days**	**Sat 10/24/15**	**Fri 11/20/15**	**15**
27		Advisor approved research methods	1 day	Sun 10/25/15	Sun 10/25/15	15FS+1 day
28		**Complete Draft of PM plan**	**28 days**	**Sat 10/24/15**	**Fri 11/20/15**	



Project: Cory Smith - Capstone, pr
Date: Wed 4/6/16

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Critical
Milestone	External Milestone	Manual Task	Start-only	Critical Split
Summary	Inactive Task	Duration-only	Finish-only	Progress

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
29		Introduction	1 day	Sat 10/24/15	Sat 10/24/15	16
30		Scope Plan	3 days	Sun 10/25/15	Tue 10/27/15	29
31		Schedule Plan	3 days	Wed 10/28/15	Fri 10/30/15	30
32		Change Plan	3 days	Sat 10/31/15	Mon 11/2/15	31
33		Communications Plan	3 days	Tue 11/3/15	Thu 11/5/15	32
34		Cost Plan/budget	3 days	Fri 11/6/15	Sun 11/8/15	33
35		Procurement Plan	3 days	Mon 11/9/15	Wed 11/11/15	34
36		Quality Plan	3 days	Thu 11/12/15	Sat 11/14/15	35
37		Risk Plan	3 days	Sun 11/15/15	Tue 11/17/15	36
38		HR Plan	3 days	Wed 11/18/15	Fri 11/20/15	37
39		Refined project deliverables	7 days	Sat 10/24/15	Fri 10/30/15	
40		Update Knowledge Areas for Planning Phase	7 days	Sat 10/31/15	Fri 11/6/15	39
41		Create/Refiine Knowledge Areas for Execution Phase	5 days	Sat 11/7/15	Wed 11/11/15	40
42		Updated Gantt Chart	3 days	Thu 11/12/15	Sat 11/14/15	41
43		Final WBS	1 day	Sun 11/15/15	Sun 11/15/15	42
44		PPM 4 Deliverable	0 days	Fri 11/20/15	Fri 11/20/15	27,28,39,4(
45		GO/NO-GO Decision	0 days	Wed 11/25/15	Wed 11/25/15	
46		**Final Presentation**	**32 days**	**Sat 10/31/15**	**Tue 12/1/15**	
47		Create Powerpoint Slides	28 days	Sat 10/31/15	Fri 11/27/15	28SS+7 day
48		30 minute presentation	0 days	Tue 12/1/15	Tue 12/1/15	47FS+4 day
49						
50		**Execution Phase (2nd Semester)**	**129 days**	**Wed 12/2/15**	**Fri 4/8/16**	
51		Conduct Literary Research	45 days	Wed 12/2/15	Thu 1/28/16	48
52		Additional literary research, with change of scope	30 days	Fri 1/29/16	Sat 2/27/16	51
53		Christmas/New Year Holiday Break	13 days	Wed 12/23/15	Mon 1/4/16	
54		**Survey**	**16 days**	**Tue 1/5/16**	**Wed 1/20/16**	
55		Finalize Survey	16 days	Tue 1/5/16	Wed 1/20/16	53



Project: Cory Smith - Capstone, pr
Date: Wed 4/6/16

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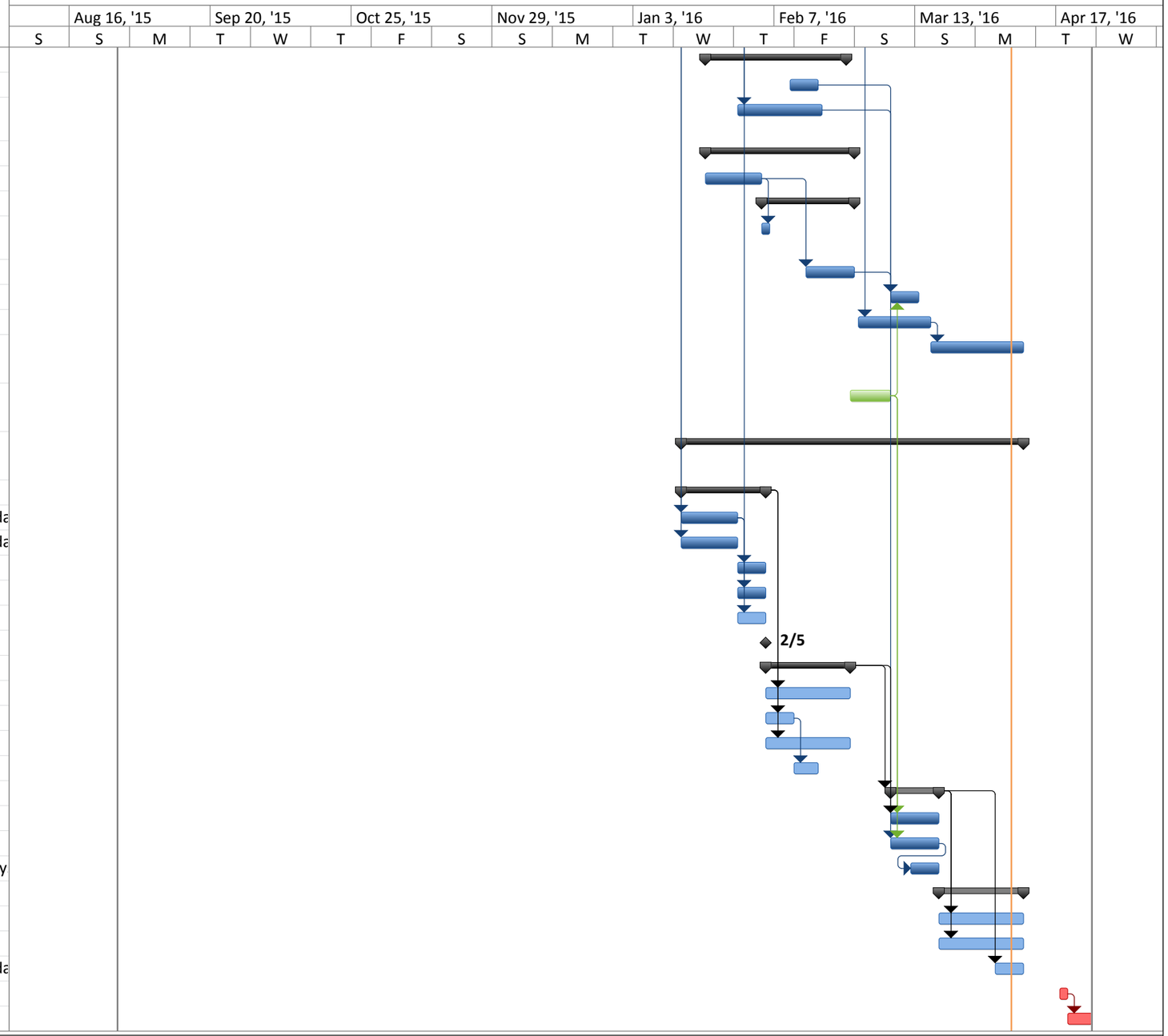
Split	External Tasks	Inactive Summary	Manual Summary	Critical
Milestone	External Milestone	Manual Task	Start-only	Critical Split
Summary	Inactive Task	Duration-only	Finish-only	Progress

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
56		~~**Conduct Survey**~~	~~**35 days**~~	~~**Wed 1/20/16**~~	~~**Wed 2/24/16**~~	
61		~~Evaluate Data~~	~~7 days~~	~~Thu 2/11/16~~	~~Wed 2/17/16~~	~~58~~
62		Conduct Secondary Research, after change of scope	21 days	Fri 1/29/16	Thu 2/18/16	57,51
63		**Interview**	**37 days**	**Thu 1/21/16**	**Fri 2/26/16**	
64		Finalize Interview	14 days	Thu 1/21/16	Wed 2/3/16	57
65		**Conduct Interview**	**23 days**	**Thu 2/4/16**	**Fri 2/26/16**	
66		Send out request for interview dates	2 days	Thu 2/4/16	Fri 2/5/16	64
67		Conduct Interview	12 days	Mon 2/15/16	Fri 2/26/16	64
68		Compile and evaluate All Data	7 days	Mon 3/7/16	Sun 3/13/16	61,67,71
69		Develop 1st draft of report	18 days	Sun 2/28/16	Wed 3/16/16	52
70		Edit, finalized report	23 days	Thu 3/17/16	Fri 4/8/16	69
71		Vacation to Texas	10 days	Fri 2/26/16	Sun 3/6/16	
72		**PPM DELIVERABLES**	**85 days**	**Fri 1/15/16**	**Fri 4/8/16**	
73		**PPM#1 Deliverables**	**21 days**	**Fri 1/15/16**	**Fri 2/5/16**	
74		Change Control Process	14 days	Fri 1/15/16	Thu 1/28/16	53FS+10 da
75		Risk Response Implementation	14 days	Fri 1/15/16	Thu 1/28/16	53FS+10 da
76		PMP Updates	7 days	Fri 1/29/16	Thu 2/4/16	74
77		Data/research update	7 days	Fri 1/29/16	Thu 2/4/16	51
78		KA updates	7 days	Fri 1/29/16	Thu 2/4/16	74
79		Final GSP signed	0 days	Fri 2/5/16	Fri 2/5/16	
80		**PPM#2 Deliverables**	**21 days**	**Fri 2/5/16**	**Thu 2/25/16**	
81		Updated Project Documents	21 days	Fri 2/5/16	Thu 2/25/16	73
82		Risk Response Implementation	7 days	Fri 2/5/16	Thu 2/11/16	73
83		Validated Research Analysis	21 days	Fri 2/5/16	Thu 2/25/16	73
84		Project Deliverable status	6 days	Fri 2/12/16	Wed 2/17/16	82
85		**PPM#3 Deliverables**	**12 days**	**Mon 3/7/16**	**Fri 3/18/16**	**80**
86		Updated Project Documents	12 days	Mon 3/7/16	Fri 3/18/16	80,71
87		Working Draft of Final Report	12 days	Mon 3/7/16	Fri 3/18/16	62,71
88		Preliminary Conclusions	7 days	Sat 3/12/16	Fri 3/18/16	87FS-7 day
89		**PPM#4 Deliverables**	**21 days**	**Sat 3/19/16**	**Fri 4/8/16**	
90		Draft Presentation	21 days	Sat 3/19/16	Fri 4/8/16	85
91		Final and Complete Paper	21 days	Sat 3/19/16	Fri 4/8/16	85
92		Update project docs	7 days	Sat 4/2/16	Fri 4/8/16	85FS+14 da
93		Final Presentation	2 days	Mon 4/18/16	Tue 4/19/16	
94		Final Deliverable	6 days	Wed 4/20/16	Mon 4/25/16	93



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Summary	Inactive Task	Duration-only	Finish-only	Progress	

Cory Smith

4.8.16

PM686B

WIND FARM FEASIBILITY AND COST ANALYSIS

KOBUK RIVER VALLEY, NOORVIK AND KIANA

LESSONS LEARNED – 686B

General:

Keep in mind the end deliverable or goal of the project at all times. Does the research and interviews fall in line with that goal?

One semester to finish such a large project is daunting. It is helpful to break apart the project into smaller portions of work to alleviate some of the stress. For instance, don't worry about the final report when doing the research. Focus energy on the tasks at hand and the PPM deliverables, and the massiveness of the project won't seem so intense.

Understand that this process is a learning experience. Not everything will go according to plan. Roll with the punches.

Schedule:

It is incredibly important that the break between the 686A and 686B semesters is used to get ahead on the research portion of the final report. The first draft of the final paper is due about 2/3rds the way through the 686B semester, and it will take weeks of work to write. It's important to get the research complete as early as possible, in order to focus on the data analysis and research results early.

Allocate plenty of time for each task, and then add more time to it. Nearly every portion of the project is going to take longer than anticipated. Keep enough lag and extra time in the schedule to account for this. Add some "fluff" items (such as "make up time") into the schedule to make up for items that take longer than anticipated.

Ideally, the surveys and interviews should be completed VERY early in the 686B semester. There will be a lot of time needed to review and analyze the data from these research methods, and then even more time to communicate these results in the final paper. Most likely, additional surveys or interviews will be needed than originally anticipated because some surveys will not come back or the information gathered in interviews will not be sufficient.

Scope/Changes:

Allow room for multiple changes in the project, and most importantly, keep a log of all the changes. A good tracking chart of changes will look really great in the final report.

Keep the scope of the project broad in the beginning, and narrow it as the project moves along.

Stakeholder Management:

Understand that this project involves many people, all with different schedules. The stakeholders are not as invested in the project, and will take time to respond to inquiries and requests.

Use the resources available at the Consortium Library; both online and in person. There are people there that can help with both researching, peer editing, and other things.

Communications:

Keep in touch with the advisory committee as much as possible, and understand that their replies to input may not always be timely, as they have busy schedules. It's important to get feedback early on pieces of the project documents.

Wind Farm Feasibility and Cost Analysis: Kobuk River Valley

CORY SMITH, PMP

UAA, SPRING 2016

Cory Smith, PMP

- Project Manager with Ridge Contracting, Inc – 6 years
  - Heavy Civil Construction
  - Mostly Western Alaska
  - Barging and Logistics
  - Ambler Airport, Kobuk River
  - HIGH COSTS FOR EVERYTHING!

RIDGE CONTRACTING, INC.

WESTERN ALASKA

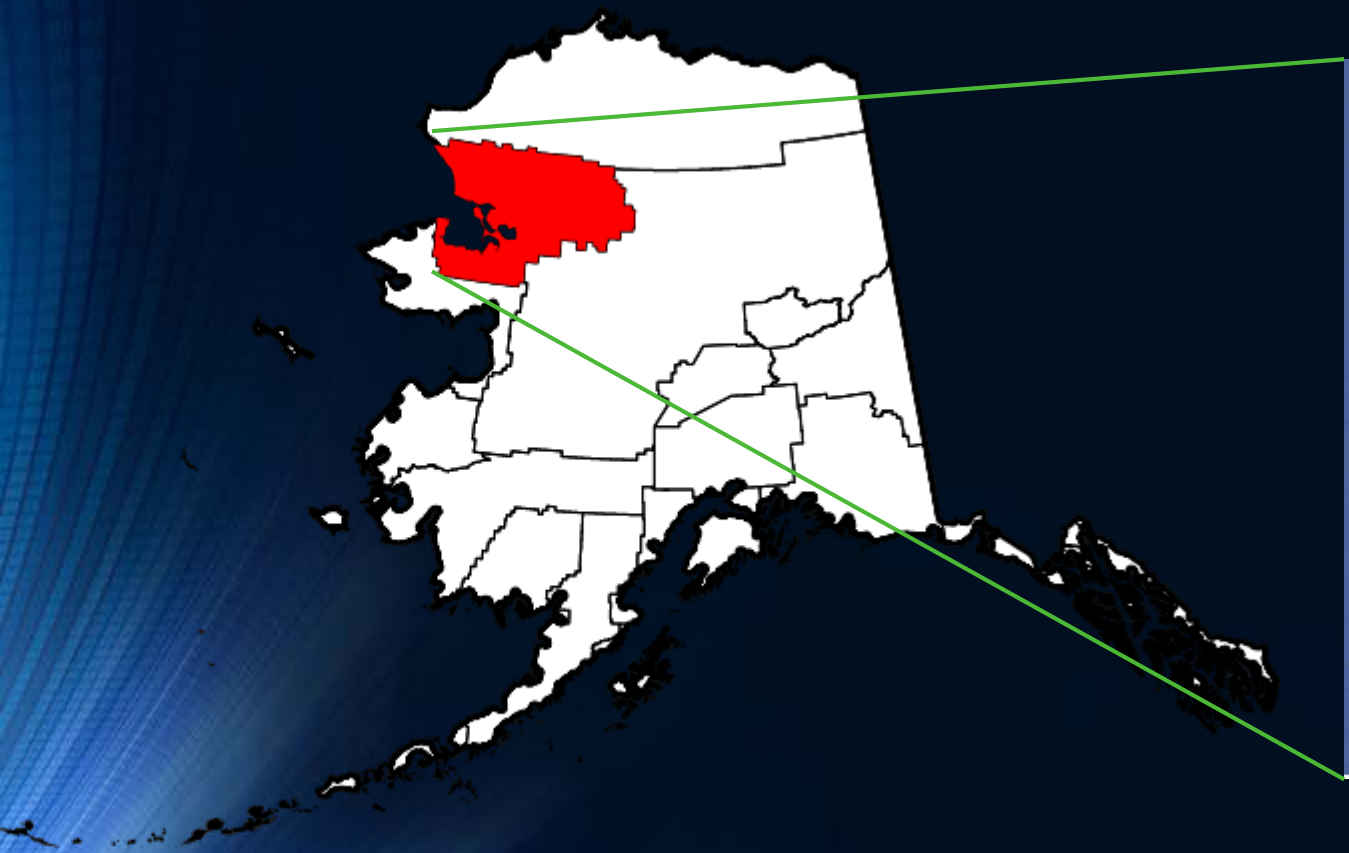
KOBUK RIVER VALLEY

- Remote
- Off the road system
- Off the grid

- $6-$8/gallon – fuel
- $300 - $500/month – electricity
  - Single family home

- Problem:
  - High Cost of Energy
    - $0.73/Kwh average
  - Reliance on Diesel Fuel
    - Instability of market, logistics
- Solution
  - Find reliable, cost effective source of energy

Northwest Arctic Borough (NWAB)



KOBUK RIVER VALLEY

- NOORVIK
- KIANA

Wind Farms

- Renewable
- Environmentally friendly
- Diesel offset
- Lower cost of energy
- Available grant funding

- Northwind 100 Turbine

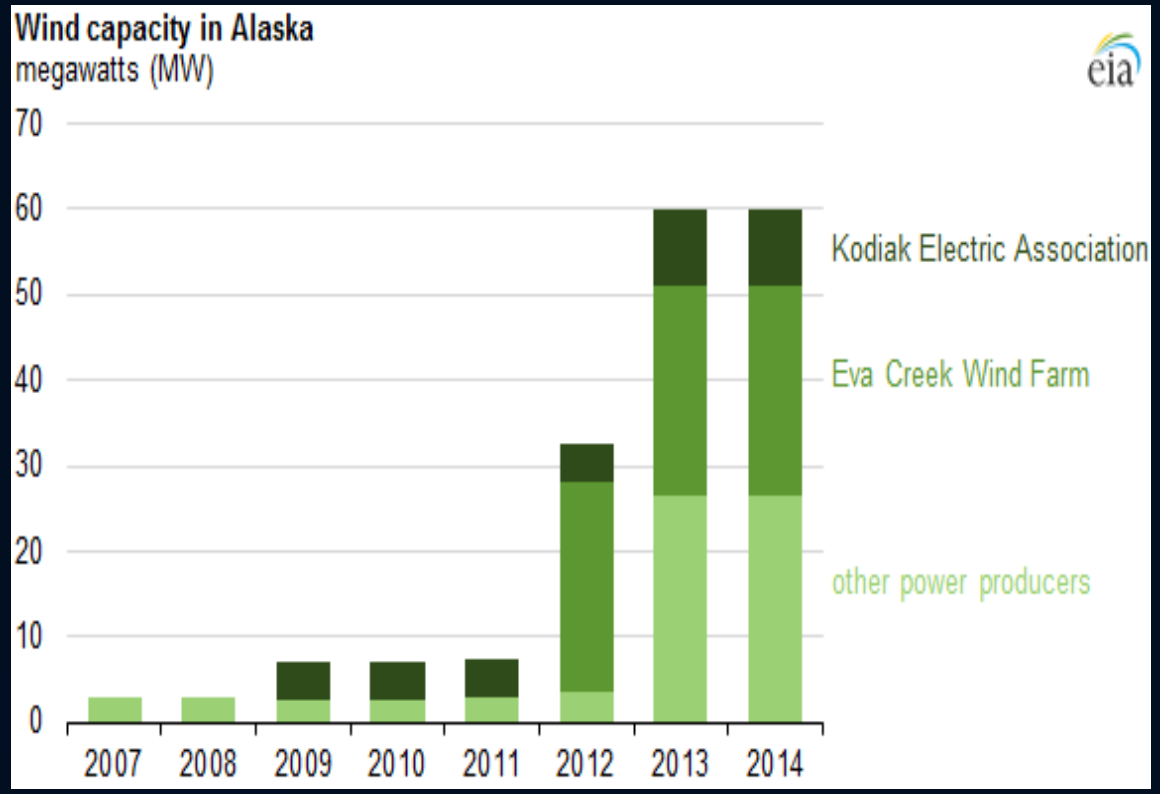
CAPSTONE PROJECT

- Planning Phase
  - 686A, Fall 2015
  - Scope of Project
  - Project Management Plan
- Execution Phase
  - 686B, Spring 2016
  - Changes, Changes, Changes
    - 20+ changes on project
  - Surveys vs. Interviews

Change #	Date	Description of need of change and change request	Project documents to update	Effects on project / comments
1	1/12/2016	Original project scope is too broad. Also, existing tool has been created at a national level, and is not user friendly or effective. Change scope to cost analysis of new wind farm in Kobuk River (see scope plan for more detail)	Project Scope, Product Scope, Project Schedule, Survey questions, RTM	Some change in scope was already noted in the risk management plan. This should only affect the length of the literary research phase of the project.
2	1/25/2016	Change Management Plan changed to delete change request for scope changes. It would be too time consuming to wait on approval on all changes	Change Management Plan	Help expedite the change process, which will allow for previous schedule slips to be corrected.
3	1/25/2016	Not a single survey has been returned. It does not appear that the data received from this scope of the project will be useful. Additional interviews will be added to the scope to gather more information	Scope, schedule, stakeholder register	This will affect the project schedule, as more interviews will need to be added. It will also affect the end results of analyzing data, as the data source will now be different.
4	1/25/2016	Added new committee member, update stakeholder information	communications mgmt plan, stakeholder register	No major effect on project.
5	1/26/2016	Need to revise schedule in order to adjust for change in scope. Also will be revising WBS.	Schedue, WBS	Crash some items in project in order to complete on time (such as 2nd phase of research)
6	2/13/2016	Project abstract needs to be changed to include new scope of work	Update project abstract, update intro/abstract of PM plan	No major effect on project.

CAPSTONE PROJECT, cont.

- Literary Research
  - Lack of data – relatively new in Alaska
- Survey
  - ZERO returned surveys!!!
- Interviews
  - Best source for information
  - Program Manager, Wind and EETF – AEA
  - Energy Manager – NWAB
  - Director of Alternative Energy - NANA



CAPSTONE PROJECT, cont.

- General research
- Feasibility analysis
- Cost analysis
  - *Planning Costs + Construction Costs + M & O Costs (NPV) – Diesel Offset (NPV) = Total Project Cost*
- Recommendation (Final Product)

Power Cost Equalization Subsidy

- Mitigates high cost of energy in rural Alaska
- Pays first 500 Kwh of energy use per month
- Residential only
- 2013 – 2014
  - Kiana - $289,000, or $0.45/Kwh
  - Noorvik - $448,000, or $0.45/Kwh
- Goal: pay same rate as Anchorage/Fairbanks average

Renewable Energy Fund

- State grant money for renewable energy projects
- $200+ million since 2008

- $10 million to NWAB in 2009
  - Deering
  - Buckland
  - Noorvik

ALASKA ENERGY AUTHORITY

Wind Energy Potential and Penetration

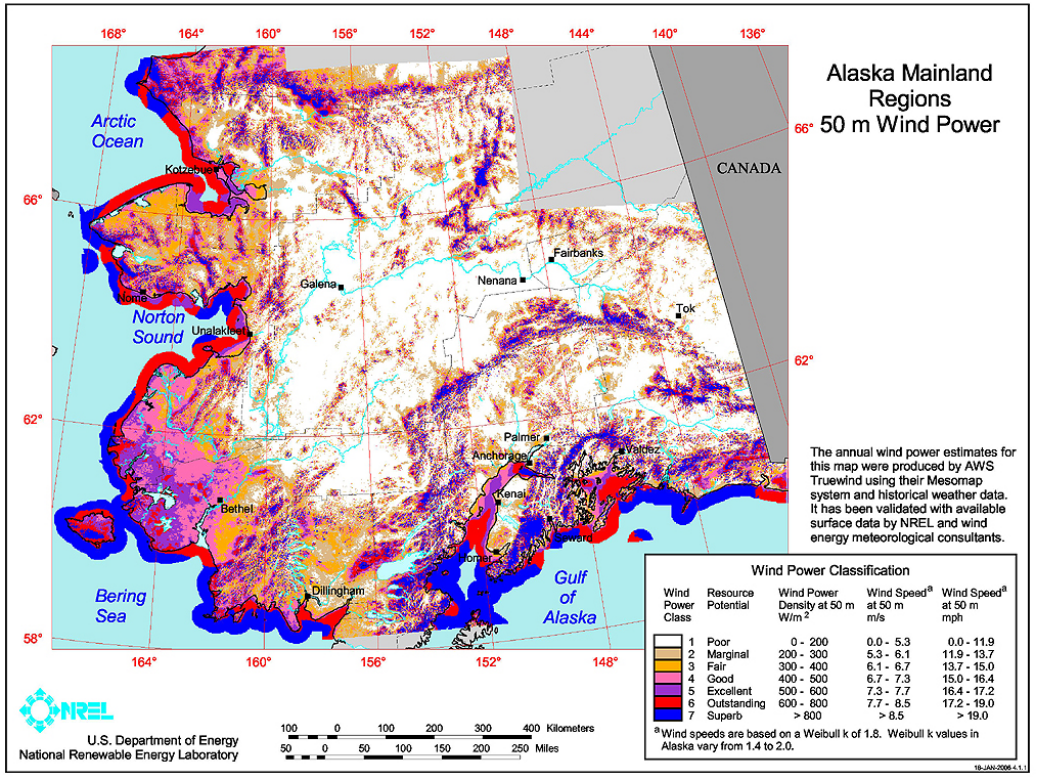
- Class 3: viable
- Wind Penetration
- Medium Penetration
  - 20%-30% offset
- Low Penetration
  - 8%-20% offset

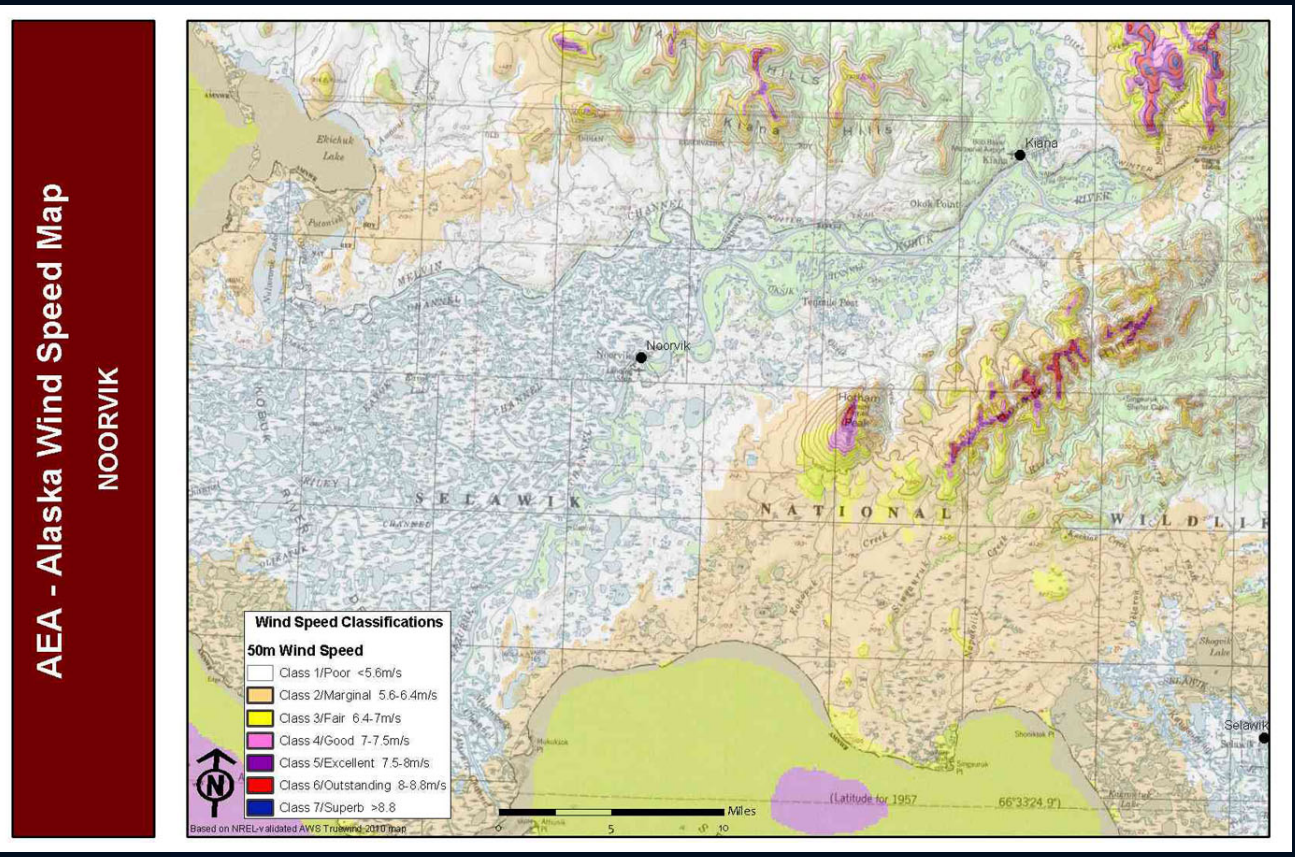
Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m^2	Wind Speed[a] at 50 m m/s	Wind Speed[a] at 50 m mph
1	Poor	0 - 200	0.0 - 6.0	0.0 - 13.4
2	Marginal	200 - 300	6.0 - 6.8	13.4 - 15.2
3	Fair	300 - 400	6.8 - 7.5	15.2 - 16.8
4	Good	400 - 500	7.5 - 8.1	16.8 - 18.1
5	Excellent	500 - 600	8.1 - 8.6	18.1 - 19.3
6	Outstanding	600 - 800	8.6 - 9.5	19.3 - 21.3
7	Superb	> 800	> 9.5	> 21.3

[a] Wind speeds are based on a Weibull k of 2.4 at 500 m elevation.

Feasibility – Kobuk River Valley





Diesel Offset

- Current power plants, diesel power
  - Barged or flown in
- 8-20% offset for low penetration wind system
- Kiana – 140,000 gallons/year
- Noorvik – 160,000 gallons/year

- @ 10%, 30,000 gallons/year – @ $4.5/gal - $2 million offset in 20 years

Estimating for Cost Analysis

- Analogous
  - Deering/Buckland Projects
- Industry Experts
  - Interview information
    - Up to date
    - Known costs
    - Already researched
- Three Point Estimating
  - Best case, Most likely, Worse case

- **Planning costs** :
- Finance charges (interest payments)
- Project management
- Design
  - Wind analysis
  - Geotechnical survey
  - Permitting, Land acquisition
  - Construction design and engineering

- **Construction costs** :
- Installation of transmission lines
- Procurement and installation of wind turbines
  - To include site mobilization and site prep
- System upgrades

- **M&O costs**:
- Commissioning of new system
- Initial training
- Equipment upgrades during operation
- General maintenance and troubleshooting

OVERALL MODEL:

Planning Costs + Construction Costs + M & O Costs (NPV) – Diesel Offset (NPV) = Total Project Cost

Project Planning

- Finance charges (interest payments)
  - Low or near-zero interest on certain grants
- Project management
  - AEA – general contributor
  - NANA – "in-kind"
- Noorvik/Deering/Buckland
  - Awarded $10 mil in 2009
  - $1 mil Noorvik, wind studies

Design - $1 million

- Wind analysis: < $100k
  - Determine wind class
  - V3 Energy, LLC
- Geotechnical survey: $550k
  - No roads or trail
  - Rigorous terrain
- Permitting, Land acquisition: < $100k
  - NWAB, Title 9 Permit
  - SWPPP
  - Native allotment or NWAB subsistence land
- Construction design and engineering: $433k
  - Engineering firm, lengthy/expensive

Project Construction

- Installation of transmission lines: $300k / mile - $7.8 million (26 miles)
- Procurement and installation of wind turbines: $1.05 million each
  - Includes site mobilization and site prep

Project Construction, cont.

- System upgrades: $600k

- Old diesel power plants
- Lack of storage
- No automatic controls, SCADA

Project Operations

- Commissioning of new system: $50k
  - Special manufacturer reps, usually from lower 48
- Initial training
  - Kotzebue, AVEC
- Equipment upgrades during operation: $150k
  - Energy storage
  - Controls
- General maintenance and troubleshooting

- IN ADDITION TO EXISTING SYSTEM ONLY

MODEL:

Planning Costs + Construction Costs + M & O Costs (NPV) – Diesel Offset (NPV) = Total Project Cost

$1,039,000 + $12,600,000 + $200,000 - $2,000,000 = $11,839,000

3-5 year project – $2.5 mil to $4 mil per year funding

Renewable Energy Fund – limited in recent years

$4 mil total estimated 2016

Recommendation

- Wind Energy Potential - YES
- Feasible – YES
- Cost – NO

- Not enough grant money to fund this project, at this time
- Project put on hold with continued research on wind/location

THANK YOU!

Questions or Comments?

*all figures in thousands

					Development and planning							Construction						O & M	
	Year	Year																Commissioning /	Equip.
Project	Started	complete	TOTAL	TOTAL	Finance (int.)	PM	Wind Analysis	Feasibility	geotechnical	Permit	Eng. Design	TOTAL	Turbines (delivered)	Site prep/construction	Transmission	System Integration	TOTAL	Training	Upgrades
													delivered (992k x2)		$280 / mile x4				
Buckland	2008	2015	$6,688	**$732**	insig. - REF	in kind (NANA)	$97	$104	$161	$28	$342	**$5,956**	$1,984	$2,852	$1,120				
															$266/mile x 1.5				
Deering	2008	2015	$2,700		insig. - REF	in kind (NANA)	$101								$400	$240			
Noorvik	2008	n/a	$1,000		insig. - REF	in kind (NANA)													
Kasigluk		2006										**$3,275**							
Shungnak (conceptual)		n/a	$5,600					$85											
interview results							~ $100	$150 - 200	$75 - 150	$25 - 50	$300 -500	$5000 - 8000	$300 - 600 (NREL) $1200 - 1700 (Strom) $1000 -1500 (AEA)		$200-2000/mile	$100 - 150 (new system) $250 - 500 (old system)		~ $50	$50 -150

NOORVIK / KIANA					Development and planning							Construction					O & M	
Estimating Method					analagous	analagous	3 point	3 point	3 point	3 point	3point		3point	analagous	analagous	analagous	Exp. Know.	Exp. Know.
Best case (a)							$97	$85	$75	$25	$300		$600					
Most likely (m)							$100	$175	$161	$28	$450		$1,000					
Worse case (b)							$101	$200	$150	$50	$500		$1,700					
3 point est. [(a+4m+b)/6]			**$13,839**	**$1,039**			$100	~~$164~~	~~$145~~	$31	$433	**$12,600**	$1,050				**$200**		
Other method, Est.					$0	$0	$25*		$550					3000**	$300	$600		$50	$150
							*initial wind study complete		3point used for site, plus 6 times Buckland for transmission line				per ea. turbine @ 4 ea - $4200	**included in turbine	per mile @ 26 miles - $7800	upgrades to 2 systems			

Cory Smith

4.8.16

PM686B

WIND FARM FEASIBILITY AND COST ANALYSIS

KOBUK RIVER VALLEY, NOORVIK AND KIANA

LESSONS LEARNED – 686B

General:

Keep in mind the end deliverable or goal of the project at all times. Does the research and interviews fall in line with that goal?

One semester to finish such a large project is daunting. It is helpful to break apart the project into smaller portions of work to alleviate some of the stress. For instance, don't worry about the final report when doing the research. Focus energy on the tasks at hand and the PPM deliverables, and the massiveness of the project won't seem so intense.

Understand that this process is a learning experience. Not everything will go according to plan. Roll with the punches.

Schedule:

It is incredibly important that the break between the 686A and 686B semesters is used to get ahead on the research portion of the final report. The first draft of the final paper is due about 2/3rds the way through the 686B semester, and it will take weeks of work to write. It's important to get the research complete as early as possible, in order to focus on the data analysis and research results early.

Allocate plenty of time for each task, and then add more time to it. Nearly every portion of the project is going to take longer than anticipated. Keep enough lag and extra time in the schedule to account for this. Add some "fluff" items (such as "make up time") into the schedule to make up for items that take longer than anticipated.

Ideally, the surveys and interviews should be completed VERY early in the 686B semester. There will be a lot of time needed to review and analyze the data from these research methods, and then even more time to communicate these results in the final paper. Most likely, additional surveys or interviews will be needed than originally anticipated because some surveys will not come back or the information gathered in interviews will not be sufficient.

Scope/Changes:

Allow room for multiple changes in the project, and most importantly, keep a log of all the changes. A good tracking chart of changes will look really great in the final report.

Keep the scope of the project broad in the beginning, and narrow it as the project moves along.

Stakeholder Management:

Understand that this project involves many people, all with different schedules. The stakeholders are not as invested in the project, and will take time to respond to inquiries and requests.

Use the resources available at the Consortium Library; both online and in person. There are people there that can help with both researching, peer editing, and other things.

Communications:

Keep in touch with the advisory committee as much as possible, and understand that their replies to input may not always be timely, as they have busy schedules. It's important to get feedback early on pieces of the project documents.

Cory Smith

UAA PM686B

4.7.16

WIND FARM FEASIBILITY AND COST ANALYSIS
KOBUK RIVER VALLEY, NOORVIK AND KIANA

Knowledge Area Processes Applied

PPM #4 Updated 4.7.16 with Measurement Data

1. Schedule/Time Management

Performance Measurement

- PPM Deliverables on time: Scale 1-10 pts (weighted 75% of total)
- Individual Tasks on time: pass/fail score 0 or 1 pts (weighted 25% of total)
- Combine pts earned divided by pts possible at each milestone (PPM deliverable date)

There are between 5 and 10 tasks per each deliverable, so using a scaled total value for the PPM deliverable out of 10 will weigh the total metric if everything is complete at the end. For instance, if only 1 out of 9 tasks are completed on time, but all are finished by the milestone, the score will be 10/10 on the PPM deliverable, and 1/9 on the individual tasks, for a total score of 10/19.

The goal is to get an 80% score on this metric, with a constraint of getting at least a 90% on the PPM#3 deliverable, and a 100% on the PPM #4 deliverable.

To date Performance (as of 2.4.16):

- PPM #1 deliverable: 8 out of 8 – All PPM#1 deliverables turned in
- PPM #1 individual tasks (literary research, survey out, finalize interview questions): Fail 0/1 pts. The literary research is not complete yet because of the project scope change.
- PPM1 SCORE: 8/8 = 75/75%, 0/1 = 0/25% - TOTAL 75%

To date Performance (as of 2.24.16):

- PPM #2 deliverable: 7 out of 7 – All PPM #2 deliverables turned in
- PPM #2 individual tasks (research, paper writing, interviews): Pass 1/1 pts. All of the scheduled tasks per the project schedule have been completed on time within this PPM period
- PPM2 SCORE: 7/7 = 75/75%, 1/1 = 25/25% - TOTAL 100%

To date Performance (as of 3.16.16):

- PPM #3 deliverable: 5 out of 5 – All PPM #3 deliverables turned in
- PPM #3 individual tasks (report, updates): Pass 1/1 pts. All of the scheduled tasks per the project schedule have been completed on time within this PPM period
- **PPM3 SCORE: 5/5 = 75/75%, 1/1 = 25/25% - TOTAL 100%**

To date Performance (as of 4.7.16):

- PPM #4 deliverable: 5 out of 5 – All PPM #4 deliverables turned in
- PPM #4 individual tasks (report, updates): Pass 1/1 pts. All of the scheduled tasks per the project schedule have been completed on time within this PPM period
- **PPM4 SCORE: 5/5 = 75/75%, 1/1 = 25/25% - TOTAL 100%**

- **Average: 93.8%, passing**

Lessons Learned: Throughout the project, this knowledge area was widely a success. Very little slip in the schedule occurred. Keeping the scheduled tasks simple and with many days of lag allowed for a near perfect application of this knowledge area. The goal of 80% was easily met.

2. Scope/Change Management

Performance Measurement

1. A fully developed change control process by PPM #1: Scaled 1 to 5 (3 being highest quality)
2. A change tracking log properly updated at least once every PPM: 0 or 1 pt per PPM, total of 4.
3. A scope change document will be created by PPM#2 milestone: Scaled 1 to 5 (5 being highest quality)
4. Final WBS compared to Initial WBS – are all changes tracked: 0 to 1, no or yes – per change. For instance, if there are ten new items on the WBS, and only six of them are on the change tracking log, this would be a score of 6/10.

The goal is to get an 80% score on this metric.

To date Performance (as of 2.4.16):

- PPM #change control process: 5 out of 5 – change management has been successful and well documented
- PPM #1 change tracking log: 1 pt, updated multiple times first period
- PPM #1 WBS tracking: 1 pt, it appears all the changes on the WBS have been properly tracked
- PPM1 SCORE: 7 out of 7 – 100%

To date Performance (as of 2.24.16):

- PPM #2 change control process: 3 out of 5 – change has occurred in the project, but not all of the changes followed the exact process described in the PM plan.
- PPM #2 change tracking log: 0 pt, very little updating of the change log occurred
- PPM#2 WBS tracking: 1 pt, the new interviews and other changes were made on the WBS/schedule
- PPM2 SCORE: 4/7 = 57%

To date Performance (as of 3.16.16):

- PPM #3 change control process: 5 out of 5 – very little changes were made during this phase of the project, and the change control process was followed.

- PPM #3 change tracking log: 1 pt, the change log has been updated per the plan.
- PPM#3 WBS tracking: 0 pt, the changes were not accurately depicted in the schedule/wbs
- PPM3 SCORE: 6/7 = 86%

To date Performance (as of 4.7.16):

- PPM #4 change control process: 5 out of 5 – only a few small changes were made during this phase of the project, and the change control process was followed.
- PPM #4 change tracking log: 1 pt, the change log has been updated per the plan.
- PPM#4 WBS tracking: 1 pt, the changes were accurately depicted in the schedule/wbs
- **PPM3 SCORE: 7/7 = 100%**

- **Average: 85.8%, passing**

Lessons Learned: There were a lot of changes in the project, and the change log accurately reflects that. Not all of the changes that occurred early on were accurately shown in the log or done with the exact process, but were corrected in the end. The goal of 80% was met.

3. Stakeholder Management

The performance metric will be based on how well the needs of the stakeholders are met, and how well the communication with stakeholders is handled and tracked.

Performance Measurement

1. Stakeholder Register updated once per PPM: score 0 or 1, 4 pts total for semester
2. Three contacts with stakeholders for survey – initial, phone call asking if they are interested in survey, followed by email; second, email sending the survey, followed by phone call; third, follow up phone call and/or email. Score 0-10
3. Interview contacts – Score 0-5
4. Stakeholder identification, initial register vs. final register: currently there are 17 stakeholder groups on this project, final number will determine score: score 1-3, 3 pts for <3 stakeholders added, 2 pts for 4-8 stakeholders added, 1 pt for >8 stakeholders added. This will score how well the initial identification went.

The goal is to get an 80% on this metric.

To date Performance (as of 2.24.16):

- PPM 1 Register: has not been updated, 0/1
- PPM 1 Contacts with surveyees: 7/10, initial phone call and email – no follow up email, yet
- PPM 1 Interview contacts: 2/5, one contact made, and interview scheduled
- PPM 1 P/I grid changed/tracked: no changes made to date, but nothing major needed 1/3
- PPM #1 SCORE: 10/19 = 53%

To date Performance (as of 2.24.16):

- PPM 2 Register: has not been updated, 0/1
- PPM 2 Contacts with surveyees: not pertinent to this PPM
- PPM 2 Interview contacts: 5/5, all three interviews complete, follow up emails also complete
- P/I grid changed/tracked: no changes made to date, but nothing major needed 1/3
- PPM2 SCORE: 6/9 = 67%

To date Performance (as of 3.16.16):

- PPM 3 Register: has not been updated, 0/1
- PPM 3 Contacts with surveyees: not pertinent to this PPM
- PPM 3 Interview contacts: 2/5, all three interviews complete, but no follow up emails sent for further correspondence
- P/I grid changed/tracked: no changes made to date, failure on this item 0/3
- **PPM3 SCORE: 2/9 = 22.2%**

To date Performance (as of 4.7.16):

- PPM 4 Register: has been updated 1/1
- PPM 4 Contacts with surveyees: not pertinent to this PPM
- PPM 4 Interview contacts: 4/5, all three interviews complete, with follow up emails asking additional questions and/or inviting to final presentation.
- P/I grid changed/tracked: no changes made to date, failure on this item 0/3
- **PPM4 SCORE: 5/9 = 55.5%**

- **Average: 49%, failing**

Lessons Learned: Stakeholder management was not applied very well during the process of this project. Primarily, this was due to the PM's management style, but also due to the other projects in the PM's portfolio that limited his ability to keep up with this and maintain proper communications. The goal was not met.

TOTAL SCORE AVERAGE = 76.3%, failing

Overall Lessons Learned: It has become apparent that the management style of the PM has proven to be the most important factor in the failure or success of each management knowledge area. Stakeholder communication has not been in tune with the original PM plan. However, it should be noted that this project is primarily an independent study project, so a lack of communications with internal stakeholders does not necessarily spell failure on the project. The schedule and changes were handled correctly, though, as were other management plans not shown here.

PROJECT MANAGEMENT PLAN

WIND FARM FEASIBILITY AND COST ANALYSIS
KOBUK RIVER VALLEY, NOORVIK AND KIANA

CORY SMITH
UAA PM686A

INITIAL DRAFT
11/20/15

FINAL REVISED
4/8/16

Project Management Plan Change Log

- 11/6/15
  - Add abstract to introduction
  - Edit Introduction
  - Add risk register
  - Add project objectives
  - Add product objectives
  - Add product scope
  - Add communications matrix
  - Edit change management plan – Add change tracking log
- 11/10/15
  - Milestone schedule updated
  - Add Stakeholder Register
  - Edit/Add to quality management plan
  - Edit Project Scope
- 11/15/15
  - Add stakeholder management plan
  - Update project scope
  - Update product scope
- 11/20/15
  - Formatting

- 1/20/16
  - Abstract and scope change
  - Risk register update
  - Add to change management plan
- 2/23/16
  - Abstract and scope change
- 3/18/16
  - Abstract and scope change
- 4/1/16
  - Final edits
  - Abstract change
  - Update project schedule
  - Update change log
  - Update risk register

TABLE OF CONTENTS

INTRODUCTION AND ABSTRACT

Western Alaska villages have incredibly high energy costs due to being off the road system. They rely upon the delivery of fuel by air cargo or barge cargo services for their diesel power plants. This is a particularly costly operation, and fuel prices delivered by this method are typically double, or even triple, the national average. In turn, this results in monthly electricity bills of $500/month or more for a typical household in the winter, which most families in this impoverished region can't afford. The Northwest Arctic Borough (NWAB) has some of the highest cost averages of Western Alaska, due to its extreme remoteness and very limited barging capabilities.

This Capstone project will involve researching the high energy costs in Western Alaska, with special attention to the NWAB, compared to both Alaskan and national averages; and, will research the costs of planning, construction, and operations of wind farms in Western Alaska. The project will enlist various research methods, including literary research, interviews, estimating, and cost analysis tools. It will present a cost analysis of designing, constructing, and maintaining a wind farms vs. traditional diesel generated costs. Lastly, it will provide a recommendation to whether a wind farm in the Kobuk River Valley is a worthwhile endeavor.

The final project deliverable will be a research paper and recommendation intended to be used by stakeholders in the energy industry. It will take into consideration initial investment costs, operations and maintenance costs, current subsidies, and any potential long term cost savings.

PROJECT OBJECTIVES

The objective of this project is to lower energy costs in areas of Western Alaska by allowing stakeholders in the energy industry to make informed decisions on investing in the development of renewable energy sources. A simple, yet effective cost analysis will be created and then used to give a recommendation, which will be formulated into a formal paper explaining the basis of the recommendation – whether an investment in a wind farm in the Kobuk Valley is a worthwhile endeavor.

PROJECT MANAGEMENT APPROACH

The project team will consist of the project manager, the project sponsor, and three committee members, including one advisor.

Cory Smith is the Project Manager and is ultimately responsible for the success of the project. He will direct the planning and execution of the project. He will have authority to make changes to any of the management plans, and will be responsible for developing all the project

deliverables. He will coordinate with the project team and other stakeholders, and will provide updates and information to the project sponsor. He will also be responsible for all the research and conducting the surveys and interviews.

The project sponsor is Bernie Smith, who will oversee the project and provide general recommendations to the project direction. The project advisor is LuAnn Piccard, who has the authority to make changes to the project plan. The other two committee members, Roger Hull and Steven Hatter, will review the project deliverables and provide comments or change initiatives.

PROJECT SCOPE

Introduction:

The scope of this project is three-fold: literary research, a feasibility analysis of the wind potential in the Kobuk Valley, and a cost analysis of developing, constructing, and operating a wind farm in this region. The research consists of using the consortium library and other internet based searches to find articles that relate to energy costs in Alaska and renewable energy. The research will look for previous studies done on costs of initiating renewable energy projects, primarily of wind farms. At least ten articles will be found during the initial research phase to create a baseline of data for the survey questions to relate to. At this point in the project, it is expected that scope will change slightly, based on the research. It is important the change management plan and change tracking log process is used.

The survey questions will then be developed. The survey will consist of fifteen questions that are intended to find data not found in the research. The survey will be given to at least ten stakeholders. Then, interview questions will be created, based on these findings, which will provide final input for the data collection. At this point, all of the collected data will be analyzed a feasibility and cost analysis will be used to create a recommendation for this region.

The project will be conducted in two phases: the planning phase, and the execution phase. The planning phase will include the development of this project management plan, a twenty minute presentation on this plan, and a 2-3 page lessons learned. The execution phase will involve the research, and development of the final paper and recommendation. It will produce both a research report and a power point presentation. It will also consist of a final, fully integrated document with all of the reports, data, and other applicable appendices.

Project Deliverables:

- A fully developed project management plan
- A twenty minute long power point presentation of the project plan
- A cost estimating tool
- A thirty five page research paper, with additional appendices of survey/interview/research results
- A thirty minute long power point presentation of the results of the research project, results and recommendation
- A lessons learned narrative

Project Acceptance Criteria:
All of the deliverables on this project must meet the standards outlined in the UAA PM686 class syllabus. They must also meet the pre-determined schedule of the project (see milestone baseline). The cost estimating tool must be both useful and easy to use for the average end user. The final report and recommendation must be informative, properly cited, and properly formatted per industry standard.

Project Exclusions:
This project will not include any monitoring and control phase, after execution. Once the cost estimating tool is created and some recommendations are made, no follow up action is included.

Project Constraints:
The project must be completed within two semesters. Project surveys and interviews cannot start until IRB submittal is accepted by UAA conformance department. Execution phase of the project can not begin until the PM Plan is complete. Project resources are limited to the project manager and his team; no outside labor resources may be used.

Project Assumptions:
It is assumed that enough data is available through various research methods to allow for the development of a cost estimating tool. It's believed that at least fifty percent of survey takers will respond. There are no anticipated major conflicts in the project staffs' personal lives that will interfere with the progress of the project.

PRODUCT SCOPE

The final product will be a cost analysis of the wind farm project, as outlined below. This will be utilized by decision makers for funding or initial budgetary purposes. The tool will use data from past projects or information gathered from industry experts. The final output will include a final cost and recommendation.

Cost Analysis

Planning Costs + Construction Costs + M & O Costs (NPV) – Diesel Offset (NPV) = Total Project Cost

Planning costs will include the following:

- Finance charges (interest payments)
- Project management
- Design
    - Wind analysis
    - Geotechnical survey

  - Construction design and engineering

Construction costs will include:

- Installation of transmission lines
- Procurement and installation of wind turbines
  - To include site mobilization and site prep
- System upgrades

Maintenance and Operation costs will include:

- Commissioning of new system
- Initial training
- Equipment upgrades during operation
- General maintenance and troubleshooting

PROJECT SCOPE MANAGEMENT PLAN

Introduction:
The project manager is responsible for project scope management. The project scope is outlined above in the project scope section of this project management plan. The scope is further described by the WBS work packages and milestone list. Scope will quantified by the milestone checklist. Any and all change in the scope will managed as described in the change management plan. The project advisor will have the authority for accepting the final project deliverable.

Collect Requirements/Verify Scope:
The project charter will be used to determine the baseline scope of the project. The project manager will then use the stakeholder register to determine stakeholders' needs in this project. He will also use his knowledge of the industry to determine what kind of product will be useful. Research, surveys, and interviews will be used to collect more information that can be evaluated to change the scope. Throughout the project, the project manager will evaluate the scope to ensure there is no scope creep and that any changes are correctly documented. All project documents should be checked regularly by the project manager to verify the project scope is being maintained.

Scope Measurement:
The WBS will be used primarily to measure and monitor scope. It is expected that changes in the scope will occur, so these changes must be shown on the WBS. Once a month, the project manager will check the WBS vs. the scope of the project and will analyze if changes are being

documented correctly. If more than three changes are undocumented, the project is put into a red status, and all project documents must be reviewed and updated. This will be shown in the change tracking log.

MILESTONE LIST

The below chart lists the major milestones for this Capstone project. It is divided into milestones for the planning phase (PP) and the execution phase (EP)

Milestone	Description	Date
PP PPM #1	Project Charter, Prelim schedule and WBS, Stakeholder Analysis, Support letter from sponsor, Knowledge Area Selection, 200 word abstract, Prelim GSP	9/11/15
PP PPM #2	Updated schedule and WBS, Scope Statement, KA update with metrics, Research Sources and Key Words, Prelim Research Methods, Requirements Documentation, IRB Account Established	10/2/15
PP PPM #3	Updated schedule and WBS, Project management plan draft, revised abstract, Developed research methods, expected outcomes, KA update, IRB training complete	10/23/15
1st "go/no-go" decision	Advisor will determine if the project will continue, based on progress	10/28/15
PP PPM #4	Research Instruments and Analysis, Final IRB submittal, Final Draft of PM Plan, Refined project deliverables, KA Update, KA for execution phase	11/20/15
2nd "go/no-go" decision	Advisor will determine if the project will continue, based on progress	11/25/15
PP Final Presentation	20 minute powerpoint presentation of project management plan and Capstone project	12/1/15
EP Send out Survey	Complete survey questions and send out survey to 12-15 stakeholders	1/20/16
EP Survey Complete	All surveys have been completed, and data compiled	2/10/16
EP Interview Complete	All interviews have been completed, and data compiled	3/13/16
EP Research Report	Final research report complete, with appendices	4/8/16
EP Report Presentation	Final presentation of report	4/18/16

SCHEDULE BASELINE AND WORK BREAKDOWN STRUCTURE

This project has a relatively small deliverable package, with limited work packages. Each milestone in the schedule involves only 4-8 deliverables, and they are mostly non-linear (e.g. very limited finish-start task links). Movement in the schedule between the milestones is non-consequential to the overall schedule, so the critical path moves along the milestones only.

The WBS contains no items of work that are longer than 21 days. No hours of work are built into the WBS or schedule, as the project manager is the only work resource. WBS work packages may only be changed through the change management plan, however flow of the schedule may change as needed.

The schedule and WBS are included as an appendix to this PM Plan.

STAKEHOLDER MANAGEMENT PLAN

Introduction:
The project manager will be responsible for managing stakeholders. It will be his role to create and routinely update the stakeholder register. Certain stakeholders may change interest throughout the execution phase of the project. For instance, during the survey and interview phase of the project, some of the stakeholders involved in that research will become high interest, as they will be immediately involved.

Stakeholder Identification:
The project manager will use his expert knowledge to create a stakeholder register (see below). Each stakeholder's relationship to the project will be listed, it will be determined if they are internal or external to the project, and their power and interest will be rated (on a 1-3 scale, 3 being high). Their power and interest will be used to determine a stakeholder priority (power * interest), which will then be shown on a power/interest matrix for quick reference.

Stakeholder Management:
The stakeholder priority score will be used to pay close attention to certain stakeholders. During the planning phase, any stakeholder with a score 6 or above will be communicated with regularly (see communications matrix.) During the execution phase, all stakeholders with a score of 3 or above will be routinely evaluated to for change in their interest or power. If their priority score rises above 3 during that phase of the project, communication will start with them.

STAKEHOLDER REGISTER

	Stakeholder Register			3=high, 1=low	3=high, 1=low	
ID #	Stakeholders	Relationship/Role	Internal / External	Influence/Power (high/med/low)	Interest (high/med/low)	Stakeholder Priority (power * interest)
1	Project Manager	Manage all aspects of the project, ultimately responsible for the success of the project	Internal	3	3	9
2	Project Sponsor	oversee	Internal	2	1	2
3	Advisory Board	Oversee project progress, comment on deliverables	Internal	3	2	6
4	PM686A Instructors	Oversee project progress, grade student, assist in progress	Internal	3	3	9
5	Community Members	Impacted by the energy costs	External	1	3	3
6	Local Entities (village councils, etc)	Impacted by the energy costs, effects on budgets, possible research contacts	External	1	3	3
7	Native Corporations (NANA/Calista/BSNC)	possible research contacts, information on regional effects of costs	External	1	2	2
8	Local Business (grocery stores)	effects on pricing, research contacts	External	1	2	2
9	Fuel Providers (Crowley, etc)	research contacts, data on energy costs	External	1	3	3
10	Air Cargo Providers (Everts/NAC/Ryan Air)	possible research contacts	External	1	3	3
11	Air Carriers (AK Air/Ravn/Grant/Bering Air)	possible research contacts	External	1	2	2
12	Energry Providers (AVEC/AEA)	survey contacts, data on energy costs	External	1	3	3
13	State of AK Entities (DOT/DNR/DEC)	possible research contacts, data on energy costs or capital budgets, final deliverable recipient	External	1	2	2

14	Housing Authorities (NIHA, etc)	possible research contacts	External	1	2	2
15	School Organizations (LYSD/LKSD)	possible research contacts	External	1	2	2
16	Federal Entities (BIA/EPA/USDA)	final deliverable recipient	External	1	1	1
17	Sport Fisher/Hunters	possible contacts for variable research	External	1	1	1

POWER INTEREST GRID

Power /Interest Grid		Interest		
		1	2	3
Power	1	16 17	7 8 11 13 14 15	5 6 9 10 12
	2	2		
	3		3	1 4

The above power interest grid shows that the most attention should be given to stakeholders 1, 3, and 4. It should be noted that this power interest grid may change during the different phases of the project.

CHANGE MANAGEMENT PLAN

Introduction:

Changes in this Capstone project may be initiated by any of the members of the project team, through an informal change request. This project relies heavily on information gathering, compilation of data, and results from surveys and interviews. It is essential that enough information can be collected to develop an end product. As such, it is expected that multiple changes in scope will occur. Change management is ultimately the responsibility of the project manager.

Change Process:
This change request can be in the form of an email, telephone call, or in comments made to project progress milestone (PPM) deliverables. The project manager will analyze the change request, and will either approve or disapprove of the change, depending on the extent and area of the change. All minor changes can be approved by the project manager, which is to include changes to any management plan, the scope, or minor adjustments in the PPM deliverables. Any major changes must be approved by the project advisor. A major change is defined as any variance in a project milestone and major delay in the schedule, or any change in the final project deliverable. All changes are subject to review by any or all of the project team.

Change Monitoring and Control:
These changes will be tracked in the following change tracking chart.

Change #	Date	Description of need of change and change request	Project documents to update	Effects on project / comments
Change 1 (example)	xx/xx/xxxx	Surveyee #8 does not return survey. Send out survey to additional stakeholder	Project Schedule	Already built into schedule, should have little to no effect.

Additionally, a change log will be maintained for revisions of any plans or other project documents. It will not be as detailed as above, but will only show dates of revisions.

COMMUNICATIONS MANAGEMENT PLAN

Introduction:
Generally, communications will be directed by the project manager. Most communications will be initiated by the project manager and will involve responses from other project team members. The project advisor may also initiate communications, but only to the project manager.

Communication Means:
In most cases, the communications will be done through email, however, phone calls are a secondary, acceptable method. It is expected that all emails are to be answered within 10 working days. Voice mails shall be returned within 3 business days, but are to be used only when timing is more critical. UAA Blackboard shall be another forum for posting deliverables and making comments to these deliverables. All team members, with exception to the project sponsor, have access to Blackboard, and should access the “collaboration folder” for the project manager at least once a month.

Expectations:
Notice of project deliverables being completed will be given to the project team members from the project manager once every 3 weeks. It is expected that some feedback from the project team

members will be communicated back to the manager. At least once a month, the project manager will email each project team member asking for specific advice about particular deliverables. The responses will be integrated into the project deliverables.

Standards:
Email and phone communication may be conducted informally, but still with a level of professionalism, such as might be used in an office breakroom.

Project team directory for all communications is:

Name	Title	E mail	Phone
Bernie Smith	Project Sponsor	bernies49@gmail.com	N/A
Cory Smith	Project Manager (PM)	Cwsmith6@uaa.alaska.edu	907-360-7616
LuAnn Piccard	Project Advisor	Lpiccard2@uaa.alaska.edu	907-786-1917
Roger Hull	Committee Member (CM)	rkhull@uaa.alaska.edu	N/A
Steve Hatter	Committee Member (CM)	steve.hatter@alaska.gov	907-465-3906

Execution Phase Communication:
The other form of communication will be the survey and interviews. The survey questions should be simple and direct. Most of the questions will involve yes/no or 1-5 type questions, however, a few open-ended questions on the survey will be required to allow for unanticipated answers. The survey questions will be created after the initial literary research phase of the project, so that they may be tailored to fill voids in research data. The surveys will be given to stakeholders early in the execution phase, to meet the milestone schedule. This will allow for enough time to analyze the data received.

The interview will be conducted face to face by the PM with the interviewee. The PM should use listening skills to allow for the most information to be told. It is important that the PM allows for enough time after each question to let the interviewee adequately respond. These interviews should last between 45 minutes and 1 hour.

A communications matrix is shown below. It summarizes the communications plan, and should be used by the project team to ensure compliance with the communications plan.

COMMUNICATIONS MATRIX

Description	Responsible Person	Other Parties	Purpose	Frequency / Iterations	Communication Means	Internal / External	Other Comments
Deliverable Comments	PM, Advisor	Committee Members	Provide feedback to	Every 3-4 weeks	Email and Blackboard	Internal	

		(CM)	enhance project deliverables				
Status Update	PM	Classmates	A check on project schedule	Every 3-4 weeks	Blackboard, present in class	Internal	3 minute goal
Project Meeting	PM	Advisor	Quality control on project	Once a semester	Face to Face meeting	Internal	Should be about half to 75% through semester
Surveys	PM	Surveyee	Gather information for project	15 surveys sent, 3-5 secondary surveys sent. Feb. '16	Email or mail	External	If response don't come, send out new surveys to other stakeholders
Interviews	PM	Interviewee	Gather more in-depth information for project	2-3 interviews. March '16.	Face to Face meeting	External	Expect 45mins to 1 hr for interview.

COST MANAGEMENT PLAN

This project is an educational, research project that does not include a budget, as there are no anticipated real costs. Therefore a cost management plan is not included as a part of this project management plan.

PROCUREMENT MANAGEMENT PLAN

This project will not include any procurement of materials. Therefore a procurement management plan is not included as a part of this project management plan.

SCHEDULE MANAGEMENT PLAN

The project schedule will be created using Microsoft Project 2010. Resources will not be loaded into the project, as there is only one resource (project manager time.) Each activity will be broken into work segments no longer than thirty days. Each activity will become a work package in the WBS. As mentioned above in the schedule baseline section of this project management plan, the milestones are the functioning critical path of the schedule. Each milestone shall not be delayed without having an overall effect on the entire schedule. Each individual work package may slide or move ahead without having a total effect on the project (i.e. slack or lag.)

The milestone schedule will be pre-determined by the project advisor, but it is the responsibility of the project manager to maintain the milestones. The rest of the schedule, or work packages, will be determined by and the responsibility of the project manager. Each team member, however must abide by the communication plan schedule requirements, for commenting, responding, or other activities. The project manager will determine the duration of each package, and is allowed to move the packages order and make small changes to the durations. Any crashing of the project may be completed by the project manager by utilizing additional "overtime" hours not originally intended for the project. The project advisor and other team members will be responsible for reviewing the schedule and making comments, but may not change it.

QUALITY MANAGEMENT PLAN

Introduction:
The project manager is ultimately responsible for the quality of all project deliverables. Other team members are responsible for quality audits and reviews. Quality requirements are pre-determined by a course syllabus. It is the responsibility of the project manager to use expert knowledge of the project management book of knowledge in determining quality.

Quality Metrics:
Each deliverable has a list of measures from this syllabus that will be used to determine final product quality (see quality baseline below). It is the responsibility of the project manager to understand these metrics and ensure final project deliverables meet the pre-determined standards. Course metrics based on a standard A, B, C, Fail system will be used as the final determination of quality.

Quality Control:
The project manager will check work regularly to ensure proper formatting (PMI and APA), spelling, grammar, and consistency among documents. Microsoft Office programs will be used in producing all deliverables, and have a built in grammar and spelling check system which will be used throughout the project.

Quality Audit:
The committee members will periodically audit the quality of the deliverables, and make suggestions to the project manager if quality is lacking. The project advisor will grade all deliverables, which will be the final determination of quality.

RISK MANAGEMENT PLAN

Risks will be analyzed by the project manager, and will include both internal and external risks. The project manager will make a list of risks using expert judgment as the basis of identifying risks, will evaluate the disruptive impact to the project and will evaluate the likelihood of the risk. Qualitative risk analysis will be used creating a probability and impact matrix. This metric will be used to find the top three risks or threats. These three threats will be further evaluated to decide if one of the four strategies for negative risks can be used (avoid, transfer, mitigate, or

accept). Transfer is not an option on this project due to the limited resources. The project manager will then develop a strategy to handle the threats based on the analysis. Towards the end of the project, the effect of these threats, the strategies to handle them, and lessons learned will be documented.

RISK REGISTER

RISK INDEX

Score	Color	Definition and Action Required	
(1-7)	Green	Minimal Risk	Mitigate or Accept
(8-14)	Yellow	Medium Risk	Mitigate, monitor closely
(15-25)	Red	Major Risk	Avoid, Mitigate, react immediately

Risk #	Risk Description	Probability (1-5)	Impact (1-5)	RISK SCORE	Response	Action By	Type of Action	Documentation
1	PM - Minor unanticipated schedule event (new work deadlines, unplanned travel, etc)	4	2	8	Crash Scheduled tasks, rearrange schedule	PM	Mitigate or Accept	Update Schedule
2	PM - Major unexpected event that causes unavailability of PM (car crash, etc)	1	5	5	Delay Project to next semester	PM, advisor	Accept	Update Schedule
3	Not enough data in research	2	5	10	change scope to relate to information found	PM	Mitigate	Update Scope mgmt plan, scope statement, charter
4	Surveyees do not respond to survey	5	2	10	Send out survey to additional stakeholders	PM	Mitigate	Update project documents
5	Not enough data from surveys	3	4	12	Submit further surveys, add questions to interviews	PM	Mitigate	Update project documents
6	Compiled research data is unuseable	3	5	15	re-evaluate scope, adjust scope to fit data, adjust product to fit data, gather more research data	PM	Mitigate or Avoid	Update all project documents
7	Interview subjects can't find time for interview, or give very short/non useable responses	1	5	5	Find other stakeholders to interview, lose opportunity for data	PM	Mitigate or accept	Update stakeholder register and plan, update scope statement
8	Scope Creep	5	3	15	look to change management plan, update project documents	PM	Avoid or mitigate	Update project documents, as needed

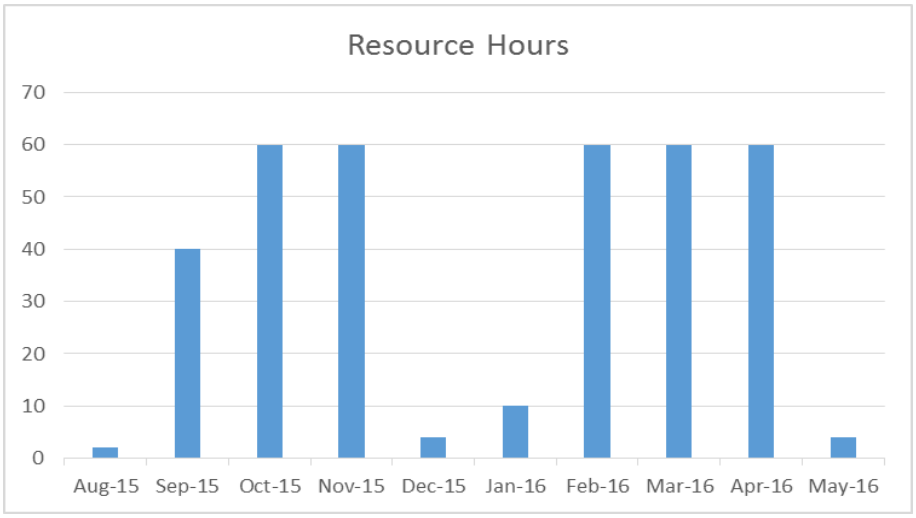
9	Project Team Members not communicating per plan	5	3	**15**	re-evaluate team members	PM	Mitigate	Update project documents, including Graduate Plan
10	Review comments for deliverables are not timely or useful	4	2	**8**	Communicate with team members per communications plan	PM, Com. Members	Accept or mitigate	record communications in log

STAFFING MANAGEMENT PLAN

The staff for this project includes the project manager, project advisor, project sponsor, and project committee members. However, the responsibility for all of the work is solely that of the project manager. Due to the relatively limited staffing management needs, a staffing management plan is not included in the project management plan.

RESOURCE CALENDAR

This project is schedule to last two semesters, or approximately eight months with a one month winter shutdown. There is only one resource on the project, the work hours of the project manager. The project manager will work on the project between ten and twenty hours a week. If needed, the project manager is allowed to work overtime (or any hours additional to twenty) to crash the project. A resource calendar is included below.



COST BASELINE

There are no costs associated with this project, therefore a cost baseline is not included as a part of the project management plan.

QUALITY BASELINE

The quality baseline for this project is based on a predetermined course syllabus. The acceptable quality levels are 90%, with the exception of the oral presentation, which only requires an 80% quality score, in order for the project to be successful. A quality baseline matrix is below.

Item	Acceptable Level	Metric
Project Progress Milestone Deliverables	Score 90% or higher	34 points PPM 1 – 4 points PPM 2 – 8 points PPM 3 – 10 points PPM 4 – 12 points
Knowledge Area Focus and Application/Measurement	Score 90% or higher	4 points All milestones, 1 point each
Oral Presentation	Score 80% or higher	20 points
Project Management Plan	Score 90% or higher	36 points Quality of content – 12 points Research of deliverables – 12 points Quality of written material – 12 points
Total	Score 90% or higher	100 points

SPONSOR ACCEPTANCE

Approved by the Project Sponsor:

_____ Date: 11.19.15

Bernie Smith
Owner, Energy For Alaska

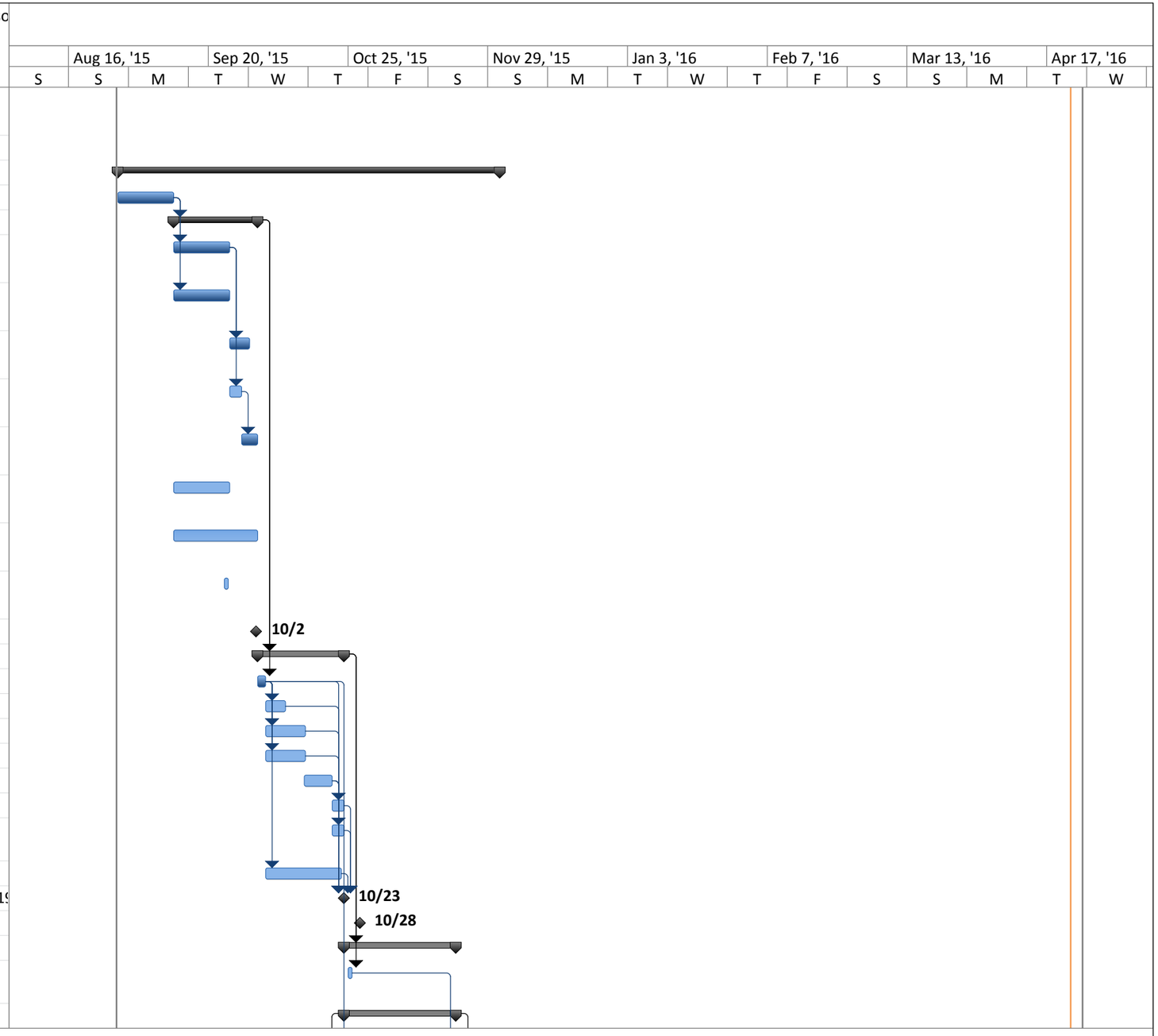
APPENDICES

- Requirements Traceability Matrix
- Schedule

APPENDIX A - Requirements Traceability Matrix

Project Name	Creating a Cost Estimating Tool for Development of Renewable Energy Sources in Western Alaska							
Project Manager	**Cory Smith PMP**							
Req. #	**Requirement Description**	**WBS #**	**Responsible For**	**Priority**	**Expectations**	**Action Needed**	**Applicable Dates**	**Comments/Concerns**
R1	Complete all deliverables by milestone dates	1.1, 1.2, 1.4, 1.7, 2.11 - 2.14	PM	HIGH	All deliverables complete and at a professional level	Post deliverables to Blackboard	Milestone Dates - approximatly every 3-4 weeks. See schedule	Schedule slips due to unanticipated events in PM's life. See Risk Register
R2	Review deliverables and comment	2.3.3, 2.6.3	Advisor and Committee	Low/Medium	review of deliverables with useful comments within a reasonable time period	Make comments on all deliverables	1-2 weeks after each deliverable milestone date. See schedule	Due to committee members' varying schedules, comments may not be received by all each deliverable. This is an expected risk
R3	Literary Research and analysis	2.1	PM	Medium/High	This should be completed early to allow for influence on survey/interviews	Primarily use of the internet to find literary sources	January '16, see schedule for further information	It is important that multiple sources are used to find a wide array of information. Primarily fact based information, however, some opinion based research may be used to develop ideas.
R4	Surveys	2.3	Surveyees, PM	Medium/High	Surveyees respond both timely and with relevant, useful information	Surveys sent per schedule, follow up from PM, surveys returned per schedule	February '16, see schedule for applicable dates	It is expected that not all surveyees will respond, so 50% more surveys will be sent than needed for response. See Risk Register for further information.
R5	Interviews	2.6	PM, Interviewees	Medium/High	Interview questions are relevant, interviewees answer with enough detail	Create and conduct survey	March '16, see schedule for interview development and actual dates	The interview questions should be mostly open-ended to allow interviewees range of answers. Listening skills are needed per communication plan.
R6	Compile all data	2.7	PM	Medium	Enough data will be available after research phase of project.	Gather data from survey/interviews and research, analyze, and formulate results	Entire execution phase of project, will be an ongoing task	Complete this task until enough data is available, it may be an iterative process.
R7	Final Product - Final Report	2.8	PM	Very HIGH	A professional, properly cited, and complete report, to include appendices with PM Plan and other pertinent documents	Create final report based on research, add all deliverables to date as appendices and reference	April '16. A milestone on the project.	Include all change logs and lessons learned.
R8	Final product - Cost Template	2.9	PM	Very HIGH	An easy to use, functional, and accurate template for estimating costs	Create template for estimating costs to combine with research portion of final deliverable	March/April '16, see milestone baseline for final date.	This is the final product of the project and will be available for use by industry stakeholders.
R9	Final presentations	1.10, 2.10	PM	High	Presentations are professional, concise, and informative	Develop powerpoint presentations with suitable graphics	December '15 and May '16. Milestone dates.	This is the culmination of each semester and should be highly professional, as it is the "image" of the project.
R10								

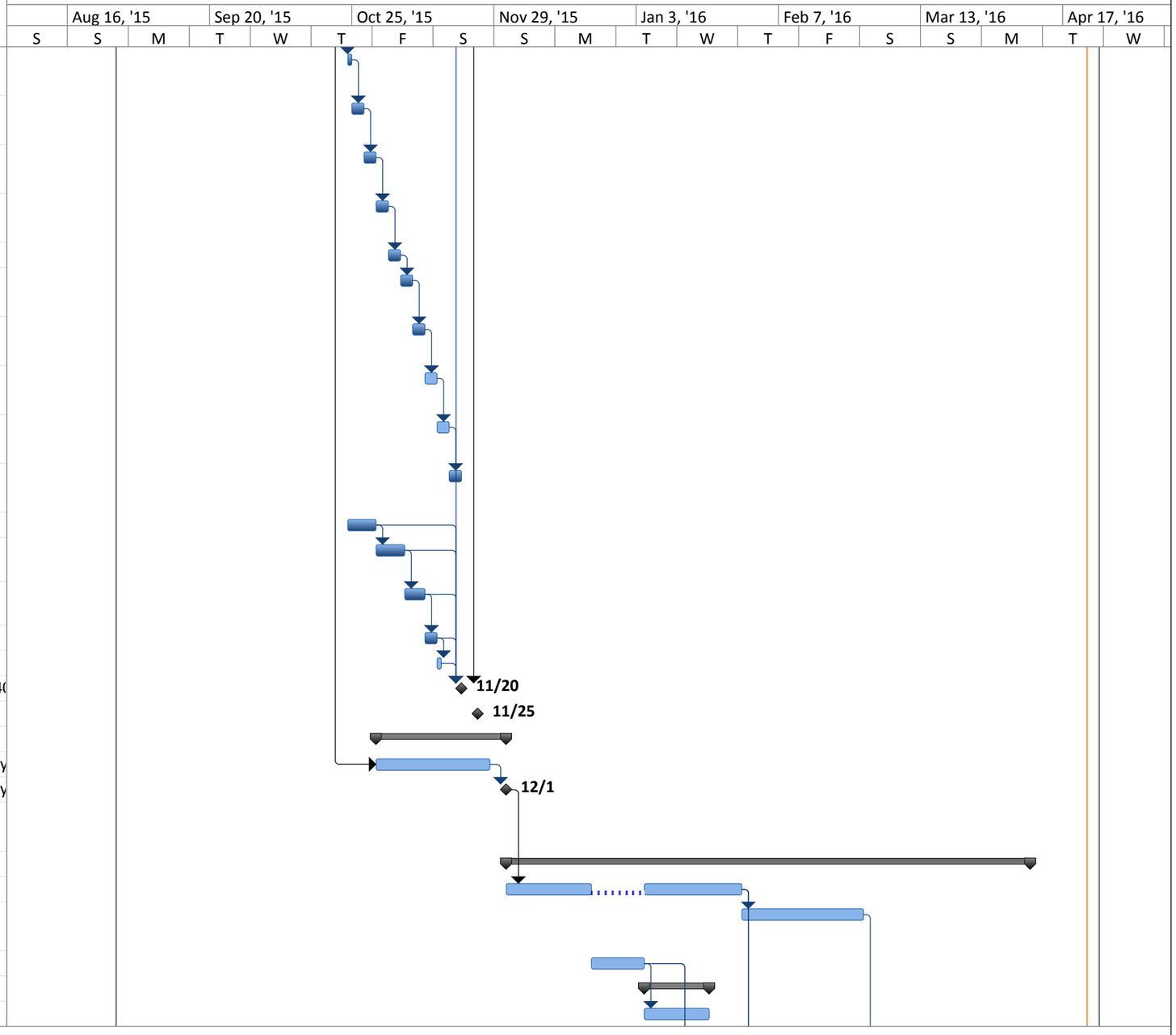
ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		Version 4.8.16 (final)				
2		Cory Smith, PM686B Project Schedule				
3		**Planning Phase (686A - COMPLETE)**	**95.92 days**	**Fri 8/28/15**	**Tue 12/1/15**	
4		PPM 1	14 days	Fri 8/28/15	Fri 9/11/15	
5		**PPM 2**	**21 days**	**Fri 9/11/15**	**Fri 10/2/15**	**4**
6		Update WBS	14 days	Fri 9/11/15	Fri 9/25/15	4
7		Update Schedule	14 days	Fri 9/11/15	Fri 9/25/15	4
8		Develop Scope Statement	5 days	Fri 9/25/15	Wed 9/30/15	6
9		Develop Requirements Documentation	3 days	Fri 9/25/15	Mon 9/28/15	6
10		Develop Table of Contents	4 days	Mon 9/28/15	Fri 10/2/15	9
11		Develop Research Plan	14 days	Fri 9/11/15	Fri 9/25/15	
12		Signed Committee Contract	21 days	Fri 9/11/15	Fri 10/2/15	
13		IRB Account Established	1 day	Thu 9/24/15	Thu 9/24/15	
14		PPM 2 Deliverable	0 days	Fri 10/2/15	Fri 10/2/15	
15		**PPM 3**	**21.92 days**	**Fri 10/2/15**	**Fri 10/23/15**	**5**
16		Revised Abstract	2 days	Fri 10/2/15	Sun 10/4/15	5
17		IRB training completed	5 days	Sun 10/4/15	Fri 10/9/15	16
18		Gantt chart/schedule update	10 days	Sun 10/4/15	Wed 10/14/15	16
19		Knowledge Areas update	10 days	Sun 10/4/15	Wed 10/14/15	16
20		VACATION (known project delay)	7 days	Wed 10/14/15	Tue 10/20/15	
21		Extended Research Methods	3 days	Wed 10/21/15	Fri 10/23/15	20
22		Description of expected products/outcomes of project	3 days	Wed 10/21/15	Fri 10/23/15	20
23		PM Plan rough draft	19 days	Sun 10/4/15	Fri 10/23/15	16
24		PPM 3 Deliverable	0 days	Fri 10/23/15	Fri 10/23/15	16,17,18,19
25		GO/NO-GO Decision	0 days	Wed 10/28/15	Wed 10/28/15	
26		**PPM 4**	**28 days**	**Sat 10/24/15**	**Fri 11/20/15**	**15**
27		Advisor approved research methods	1 day	Sun 10/25/15	Sun 10/25/15	15FS+1 day
28		**Complete Draft of PM plan**	**28 days**	**Sat 10/24/15**	**Fri 11/20/15**	



Project: Cory Smith - Capstone, pr
Date: Sat 4/23/16

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline	
Split	External Tasks	Inactive Summary	Manual Summary	Critical	
Milestone	External Milestone	Manual Task	Start-only	Critical Split	
Summary	Inactive Task	Duration-only	Finish-only	Progress	

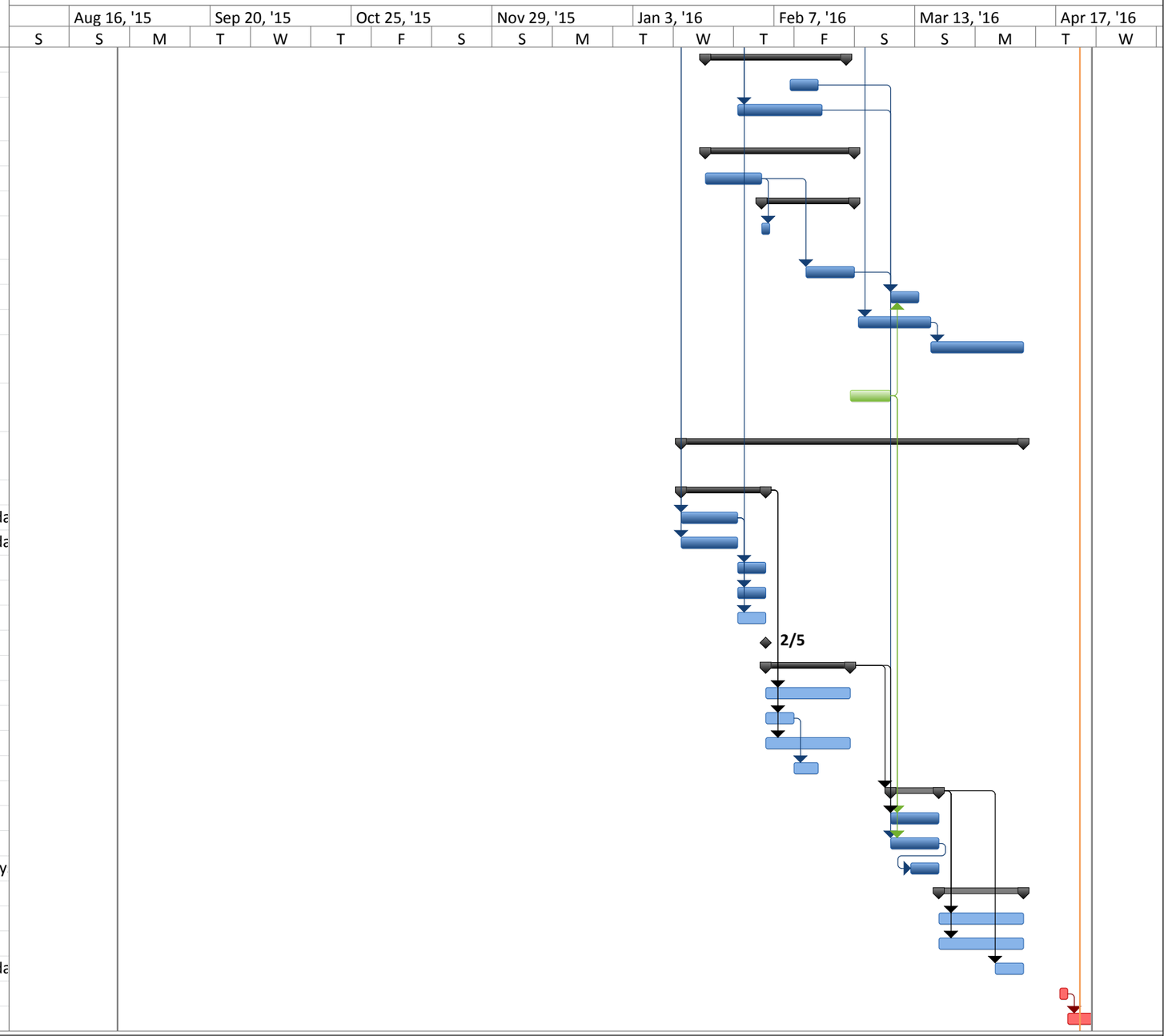
ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
29		Introduction	1 day	Sat 10/24/15	Sat 10/24/15	16
30		Scope Plan	3 days	Sun 10/25/15	Tue 10/27/15	29
31		Schedule Plan	3 days	Wed 10/28/15	Fri 10/30/15	30
32		Change Plan	3 days	Sat 10/31/15	Mon 11/2/15	31
33		Communications Plan	3 days	Tue 11/3/15	Thu 11/5/15	32
34		Cost Plan/budget	3 days	Fri 11/6/15	Sun 11/8/15	33
35		Procurement Plan	3 days	Mon 11/9/15	Wed 11/11/15	34
36		Quality Plan	3 days	Thu 11/12/15	Sat 11/14/15	35
37		Risk Plan	3 days	Sun 11/15/15	Tue 11/17/15	36
38		HR Plan	3 days	Wed 11/18/15	Fri 11/20/15	37
39		Refined project deliverables	7 days	Sat 10/24/15	Fri 10/30/15	
40		Update Knowledge Areas for Planning Phase	7 days	Sat 10/31/15	Fri 11/6/15	39
41		Create/Refiine Knowledge Areas for Execution Phase	5 days	Sat 11/7/15	Wed 11/11/15	40
42		Updated Gantt Chart	3 days	Thu 11/12/15	Sat 11/14/15	41
43		Final WBS	1 day	Sun 11/15/15	Sun 11/15/15	42
44		PPM 4 Deliverable	0 days	Fri 11/20/15	Fri 11/20/15	27,28,39,4(
45		GO/NO-GO Decision	0 days	Wed 11/25/15	Wed 11/25/15	
46		**Final Presentation**	**32 days**	**Sat 10/31/15**	**Tue 12/1/15**	
47		Create Powerpoint Slides	28 days	Sat 10/31/15	Fri 11/27/15	28SS+7 day
48		30 minute presentation	0 days	Tue 12/1/15	Tue 12/1/15	47FS+4 day
49						
50		**Execution Phase (2nd Semester)**	**129 days**	**Wed 12/2/15**	**Fri 4/8/16**	
51		Conduct Literary Research	45 days	Wed 12/2/15	Thu 1/28/16	48
52		Additional literary research, with change of scope	30 days	Fri 1/29/16	Sat 2/27/16	51
53		Christmas/New Year Holiday Break	13 days	Wed 12/23/15	Mon 1/4/16	
54		**Survey**	**16 days**	**Tue 1/5/16**	**Wed 1/20/16**	
55		Finalize Survey	16 days	Tue 1/5/16	Wed 1/20/16	53



Project: Cory Smith - Capstone, pr
Date: Sat 4/23/16

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Critical
Milestone	External Milestone	Manual Task	Start-only	Critical Split
Summary	Inactive Task	Duration-only	Finish-only	Progress

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
56		~~**Conduct Survey**~~	~~**35 days**~~	~~**Wed 1/20/16**~~	~~**Wed 2/24/16**~~	
61		~~Evaluate Data~~	~~7 days~~	~~Thu 2/11/16~~	~~Wed 2/17/16~~	~~58~~
62		Conduct Secondary Research, after change of scope	21 days	Fri 1/29/16	Thu 2/18/16	57,51
63		**Interview**	**37 days**	**Thu 1/21/16**	**Fri 2/26/16**	
64		Finalize Interview	14 days	Thu 1/21/16	Wed 2/3/16	57
65		**Conduct Interview**	**23 days**	**Thu 2/4/16**	**Fri 2/26/16**	
66		Send out request for interview dates	2 days	Thu 2/4/16	Fri 2/5/16	64
67		Conduct Interview	12 days	Mon 2/15/16	Fri 2/26/16	64
68		Compile and evaluate All Data	7 days	Mon 3/7/16	Sun 3/13/16	61,67,71
69		Develop 1st draft of report	18 days	Sun 2/28/16	Wed 3/16/16	52
70		Edit, finalized report	23 days	Thu 3/17/16	Fri 4/8/16	69
71		Vacation to Texas	10 days	Fri 2/26/16	Sun 3/6/16	
72		**PPM DELIVERABLES**	**85 days**	**Fri 1/15/16**	**Fri 4/8/16**	
73		**PPM#1 Deliverables**	**21 days**	**Fri 1/15/16**	**Fri 2/5/16**	
74		Change Control Process	14 days	Fri 1/15/16	Thu 1/28/16	53FS+10 da
75		Risk Response Implementation	14 days	Fri 1/15/16	Thu 1/28/16	53FS+10 da
76		PMP Updates	7 days	Fri 1/29/16	Thu 2/4/16	74
77		Data/research update	7 days	Fri 1/29/16	Thu 2/4/16	51
78		KA updates	7 days	Fri 1/29/16	Thu 2/4/16	74
79		Final GSP signed	0 days	Fri 2/5/16	Fri 2/5/16	
80		**PPM#2 Deliverables**	**21 days**	**Fri 2/5/16**	**Thu 2/25/16**	
81		Updated Project Documents	21 days	Fri 2/5/16	Thu 2/25/16	73
82		Risk Response Implementation	7 days	Fri 2/5/16	Thu 2/11/16	73
83		Validated Research Analysis	21 days	Fri 2/5/16	Thu 2/25/16	73
84		Project Deliverable status	6 days	Fri 2/12/16	Wed 2/17/16	82
85		**PPM#3 Deliverables**	**12 days**	**Mon 3/7/16**	**Fri 3/18/16**	**80**
86		Updated Project Documents	12 days	Mon 3/7/16	Fri 3/18/16	80,71
87		Working Draft of Final Report	12 days	Mon 3/7/16	Fri 3/18/16	62,71
88		Preliminary Conclusions	7 days	Sat 3/12/16	Fri 3/18/16	87FS-7 day
89		**PPM#4 Deliverables**	**21 days**	**Sat 3/19/16**	**Fri 4/8/16**	
90		Draft Presentation	21 days	Sat 3/19/16	Fri 4/8/16	85
91		Final and Complete Paper	21 days	Sat 3/19/16	Fri 4/8/16	85
92		Update project docs	7 days	Sat 4/2/16	Fri 4/8/16	85FS+14 da
93		Final Presentation	2 days	Mon 4/18/16	Tue 4/19/16	
94		Final Deliverable	6 days	Wed 4/20/16	Mon 4/25/16	93



Project: Cory Smith - Capstone, pr
Date: Sat 4/23/16

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline	
Split	External Tasks	Inactive Summary	Manual Summary	Critical	
Milestone	External Milestone	Manual Task	Start-only	Critical Split	
Summary	Inactive Task	Duration-only	Finish-only	Progress	

Cory Smith
Capstone Project

Creating a Cost Estimating Tool that Analyzes Costs and Savings in Developing Renewable Energy Sources in Western Alaska

Project Charter

Date Prepared: 11/18/2015
Project Owner: Cory Smith

Statement of Work:

This project will include developing a research report on the high costs of energy in Western Alaska, and the potential savings in investment in renewable or alternative energy sources. The project will also have the end product of a cost estimating tool that will be used to provide recommendations on cost saving endeavors.

Project Goal:

The objective of this project is to lower energy costs in areas of Western Alaska by allowing stakeholders in the energy industry to make informed decisions on investing in the development of renewable energy sources. A simple, yet effective cost estimating tool will be created and then used to give recommendations, which will be formulated into a formal paper explaining the basis of the recommendation – whether an initial investment in an alternate energy source is a worthwhile endeavor or not..

Budget:

There will be no anticipated major costs for this project. There will be some minor costs in transportation and in document printing. A project budget is set at $500.

Schedule:

The project will last two semesters during the UAA school year; the planning phase of the project will be during the 2015 fall semester, and the execution phase of the project will be during the 2016 spring semester. The project completion date is May 5th, 2016. Milestones for this project are listed below.

Milestone	Description	Date
PP PPM #1	Project Charter, Prelim schedule and WBS, Stakeholder Analysis, Support letter from sponsor, Knowledge Area Selection, 200 word abstract, Prelim GSP	9/11/15
PP PPM #2	Updated schedule and WBS, Scope Statement, KA update with metrics, Research Sources and Key Words, Prelim Research Methods, Requirements Documentation, IRB Account Established	10/2/15
PP PPM #3	Updated schedule and WBS, Project management plan draft, revised abstract, Developed research methods, expected	10/23/15

	outcomes, KA update, IRB training complete	
1st "go/no-go" decision	Advisor will determine if the project will continue, based on progress	10/28/15
PP PPM #4	Research Instruments and Analysis, Final IRB submittal, Final Draft of PM Plan, Refined project deliverables, KA Update, KA for execution phase	11/20/15
2nd "go/no-go" decision	Advisor will determine if the project will continue, based on progress	11/25/15
PP Final Presentation	20 minute powerpoint presentation of project management plan and Capstone project	12/1/15
EP Send out Survey	Complete survey questions and send out survey to 12-15 stakeholders	1/28/16
EP Survey Complete	All surveys have been completed, and data compiled	3/10/16
EP Interview Complete	All interviews have been completed, and data compiled	3/30/16
EP Research Report	Final research report complete, with appendices	4/30/16
EP Report Presentation	Final presentation of report	5/6/16

Roles and Responsibilities:

Cory Smith is the project manager, and will ultimately be responsible for the successful completion of this project. His responsibilities will be to conduct the planning of the project, to lead the research efforts, to organize the results, and to create the final deliverable. Bernie Smith and Drew McLaughlin are the project sponsors and will ensure that the project is completed within project constraints. LuAnn Piccard will be the project advisor, who will be responsible for reviewing and grading project progress deliverables; Roger Hull and Steve Hatter willl be the committee members; they will be responsible for evaluating progress and offering advice throughout the project.

Constraints:

This project must be completed within two semesters, with final deliverables at the end of the fall and spring semesters. This project is primarily for academic purposes, and has a budget constraint of $500 for consumable items only.

Assumptions:

It is assumed that enough data can be compiled during the relatively short research phase of the project to draw evidence-based conclusions. This data should be readily available if the proper research methods are used. It is assumed that all project sponsors and committee members will remain available to participate in this project through its lifetime.

Risks:

This project is limited to two semesters, and the research will be executed over a short period of time. There is a risk that not enough data will be found in such a short time window. The project is dependent on the project manager for all of the work, so there is also a risk that some unforeseen event occurs, which takes him away from this project.

Project Sponsor:

_____
Bernie Smith
Owner
Energy For Alaska

PROJECT SPONSOR LETTER

To: UAA Capstone Advisory Board
From: Project Sponsor
Subject: UAA Capstone Project for Cory Smith

September 10th, 2015

Greetings,

This letter demonstrates my support for Cory Smith's Capstone project, a part of his masters program at UAA. I will support his creation and implementation of a Project Management Plan, a research project, and a final deliverable.

The proposed project will research energy costs in Western Alaska. It will be completed by the end of the 2016 spring semester.

As of September 10th, 2015, Cory Smith will serve as the project manager for this project. He will ultimately be responsible for the overall success of the project. He will manage daily the project schedule and organize the project activities.

As the project sponsor, I am committed to its success, and will provide necessary support and direction to ensure the project meets the objectives documented in the project management plan.

Sincerely,

Bernie Smith

Project Sponsor
Bernie Smith
Energy For Alaska